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ON HUMAN NATURE

A. L. KROEBER

AMONG CULTURELESS or virtually cultureless animals, it is relatively easy to describe their characteristic behavior, just because it is practically unimpinged on by the highly variable factor of culture. A large component of their behavior is genetically founded, and, since physical environment tends to be stable and long-term, the effects of this environment have mostly been incorporated in the genetic constitution of the species through selection. The influence of organic environment or ecology has also been at least partly absorbed into the congenital make-up. The remainder of the organic environment is obviously, in a state of non-domestication, the principal factor which makes for individual learning.

The result is that we know pretty well the characteristic behavior patterns of bovines or felines, of chipmunks, porpoises, or elephants, of wrens and loons, of snakes and frogs. While reports by amateurs on the behavior of animals may often inject anthropomorphizing and dubious motivation, a mass of thoroughly reliable observation by zoölogists is also available. The behavior is the externally-directed functioning corresponding to the animals' bodily structure. It bears obvious resemblance, greater or less, to human behavior and conditions, and is therefore construable—provisionally at least—in "psychological" terms. In some cases we can now infer what parts of the behavior are congenital and which individually learned. In others, the discrimination can be made by sufficient observation, properly directed; or if necessary, by test. We have therefore in hand or within reach a considerable body of objective knowledge on the behavioral "nature" of various animals: the essential and constant qualitative patterns of the psychological activity of many very different species.

By contrast with all subhuman species, in man the behavioral picture is enormously complicated by his possessing culture. Culture is of course based on a

genetic endowment—indeed presumably a very special cerebral genetic endowment. But, viewed operatively, culture is supergenetic. It is acquired by learning from other individuals of the species, and is practiced and somewhat modified by each member of the human race individually; and his modifications enter into the continuum or joint product which is passed on to subsequent individuals. The chief mechanism which makes this communication of human culture possible, and thereby makes culture possible, is the faculty of symbolization and speech. This faculty is hereditary: all normal human beings possess it to an adequate degree; no other species possesses it except at best to a most rudimentary degree. It is certainly the most fruitful in effects of all the specific characteristics of man; and it is difficult not to believe that the faculty must be the result of a genetic mutation or group of mutations.

Culture, including speech and symbol or idea systems, is individually acquired —"learned" by each individual from the other individuals he associates with. As these groups of associates or societies are spread in many parts and environments all over the earth, and as these have each had a more or less separate and different history, they show much diversity. This notorious plasticity or variability of human culture is due precisely to the fact that its content and forms, its substance, are non-genetic, and are therefore exempt from the overwhelmingly repetitive and preservative influence of heredity. The customs—which viewed systematically are the culture—of human societies often differ drastically; and their languages differ radically and totally—as much perhaps as orders, classes, or even phyla of animals, if such a comparison may be made by way of illustration. Yet in their organic morphology, the most divergent human societies are only races within the confines of one zoölogic species.

Owing to the largeness of this highly variable component of culture in the make-up of human behavior, it is evident that "human nature" is a much less steadily uniform thing, and much harder to characterize, than gorilla or elephant or tiger nature. Its hereditary features carry an enormous overlay of variable features due to culture. In fact, social psychologists and some sociologists often say that there is no human nature as such—only Chinese, Italian, Hottentot, etc. human nature. This seemingly absurd statement of course means only that generic human nature is so molded or distorted or reshaped by Chinese culture in China, and by Italian in Italy, that it nowhere occurs or is given as such. This is all right as a warning to naïve fellow-psychologists that they must not assume that they are dealing with pan-human psychology when they are describing contemporary American behavior, no matter how refined their tests or statisticized their method.

Actually, of course, though it can not possibly anywhere be uncovered in its purity, original or pure human nature exists as a theoretically separable and essen-

tially constant component in the Chinese, Italian, and hundreds of other ethnic or social groups, which are fusion products of genetic, individual-accidental, and sociocultural influences.

While psychologists at least aim at universals as they pervade individuals, the first focus of anthropologists is on specific features of groups, as that of historians is on specific events or on particular and even unique conditions. Anthropologists expect to deal primarily with human nature as it is expressed in the dress of particular cultures, and are not disturbed by its particularity as psychologists would be. As a matter of fact, for several decades they have been very little troubled by what generic human nature might be, because they had come to realize that it was far more constant than actual, culture-determined human nature; so much so that they would not be far in error, in the present state of precision or imprecision of their methods, if they simply assumed, provisionally, that generic human nature was constant. At least they could assume it as averaging about constant for races and societies, though not for individuals; but then individuals were none of their first-line concern.

Incidentally, historians, who run less theory-conscious even than anthropologists, have made and do de facto make the same assumption, whether they are aware of it or not, that human nature runs alike in all larger groups of men.

The earlier anthropologists, it is true—those who promulgated broad evolutionistic speculations beginning in the decade of the *Origin of Species*, and until as late as 1895-1915—far from discounting human nature as a factor profitably ignored, built on it. They were still, as in the early phases of many sciences, confident that they were discovering unconditional universals, and progressive ones. And what was there better to derive their universals from than human nature? It was the basis and mainspring of all human action, individual and social; so institutions and beliefs just spontaneously grew out of it. Consequently beliefs and institutions in one place and another, at one time or another, tended to show a strong similarity. It was through accidents that they differed, and incidentally; in their important aspects they were similar—must be related because they all flowed out of human nature. Time and again Frazer in establishing a relationship or a sequence says: "What is more natural than that this should happen" or "that they did so and so." Frazer indeed strongly savored exotic practices and beliefs; but it was as seasoning of the steady monotony of a diet of universals that were an emanation of our nature.

Those easy, golden years of just dipping into the human nature of common experience to make anthropological science about primitives and origins are long since over. They were succeeded by the era of criticism and cultural relativism. As a result, it became apparent that human nature had not been defined; that it

would be very difficult to characterize in all the Protean forms which it assumed; that it evidently was basically rather uniform; and that it could therefore be cancelled out of our operations as a constant.

Now this period in turn is drawing to a close, and basic human nature is once more being felt as an existent. Bidney brings it into his *Theoretical Anthropology* of 1953; Spiro into a 1954 American Anthropologist article. It is a subject that is again being talked about by anthropologists; and it is clear that we cannot permanently ignore the basic genetic part of our psychology.

This essay then attempts to suggest some ways in which the problem of human nature may be grappled with.

It will however clarify this objective if we first eliminate some procedures that seem unfruitful.

First, we shall not learn to understand better what human nature is if we try to begin with a formal verbal definition of what is meant by human nature. Useful definitions come at the end of inquiry.

Second, inquiry must be systematic, utilizing the known results of previous scientific inquiry. This rules out any verbally more elaborate restatements of the commonplaces of common knowledge and common sense. It is not that these are without truth. But so do all proverbs contain truth, and yet scientific inquiry does not start from or operate with proverbs, be they overt or pedantically disguised.

Third, we may leave aside consideration of the "common denominators" of culture which have been several times proposed, exemplified, and even listed by anthropologists. Again, it is not that they are untrue; but they seem useless: no one has been able to develop the approach. I suspect the reason for this steriliy to be that the emphasizing of common denominators is at bottom an endeavor to define human nature from culture, to deduce it from culture; which is open to objection equal to that of deriving culture from human nature. The two procedures might be described as inverse forms of reductionism.

The same holds for the "universal pattern" of culture, that seed lightly tossed out by Wissler that has never germinated. Once more, the concept is not untrue; but an enumerative table of contents, while useful in its place, is not a productive tool for research.

Finally, we shall rule out "needs," including needs that appear under new names. Basically, they also are commonplaces of common knowledge. If elaborated, they are usually psychological restatements of cultural behavior.

There may be several approaches toward the problem of defining human nature, but I discern only two with any specificity. There are abundant data available for both; but the data need more systematic examination from the angle of our particular problem. Before we attain new results it may be necessary to assemble

additional facts, or to recheck or reinterpret some of those on hand. But the first step would seem to be a comprehensive and systematic shaking down, from our point of view, of what there is in hand.

The first approach is intraspecific and cultural; the second, comparative and biological.

The approach through culture is simple. It would aim to delimit the perimeters of historic human culture, as established by the most extreme expressions yet found in particular cultures, of the various activities and qualities of culture. It is not to be expected that this delimitation would per se lead to any profoundly novel discoveries. It would be an organized stock-taking, a systematic review from one angle. But the limits of human culture, both normal limits and extreme ones, are presumably set mainly if not wholly by the normal and extreme limits of congenital human nature. And such a delimitation of the expressions of human nature would at least be a first step toward defining our problem by including as well as excluding those phenomena presumably most relevant to human nature. It might be at least the beginning of an escape from the mishmash of common and inexact knowledge, common and dilettante speculation, and unrealized hangovers from religious and ethical systems, that make up our present thinking or talking about human nature.

An exemplification of "most extreme expressions" is human sacrifice as practiced by the ancient Mexicans; of frequency of cannibalism among certain Polynesians and Melanesians. In completeness, intensity, and variety of asceticism I presume the inhabitants of India have gone farthest, as they certainly have in intensity, variety, and nonresidualness of hierarchical grouping in castes, and—along with the Tibetans—in institutionalized polyandry. In the realm of thought, first prize would presumably also go to India both for philosophical pessimism and for love of classification on its own account. India is of course mentioned only for convenience of identification: it is the cultural manifestation that is the relevant material, not the place or people.

The Japanese forty-seven ronins would perhaps serve as an extreme of institutionalized loyalty. For pervasive cleanliness, neatness, order, finish, and restrictive elimination of physical superfluities, the Japanese would again come strongly into consideration; for going without artifacts, tools, and property, the Australian natives.

These examples may suffice to make my meaning clear. I have deliberately avoided citing any from Western civilization for fear of bias in perspective and evaluation where there is participation.

Even brief consideration of this topic seems to indicate that certain cultures, such as the Chinese, will be represented but rarely at the perimeter of pan-human extremity; others of equal size and weight of achievement, such as the Indian,

repeatedly. The theoretical preëminence accorded the sage and priest over the ruler; the propensity toward the abstract, the priority allowed the conceptual over the sensory, the addiction to exaggeration and absolutes, are further cases in point for India. Followed up systematically, this side-line of frequency evaluation should result in a rating of cultures on a scale of centering respectively well in the interior or toward the rim of the total range of human culture (and therefore human nature, presumably); or perhaps of nearness to different segments of the perimeter. This is of course not part of the problem of human nature as such, but it might be a by-product of the proposed line of investigation. But even as an avowed distraction this side issue serves to show how much more readily problems loom into sight when a field is viewed for a time from one consistent angle than when it is viewed indeterminately from several.

Incidentally, if this suggested side-line proved productive, it seems that the differential placing of disparate cultures within the perimeter of total human culture and total human nature might also contribute to the definition and characterization of the "modal personality" of these cultures.

At any rate, total human culture viewed historically and comparatively—cross-culturally is the modern word—obviously must essentially coincide with human nature from which it grows; and its perimeter being therefore the perimeter of human nature, this definable coincidence suggests itself as an opportune toe hold from which to start further inquiry into human nature. I do not know where else in the range of the two aspects, than at the periphery, we can allege any point-for-point correspondence of their phenomena.

It is true that potential human nature almost certainly has a slightly wider range than the sum total of known culture expressions. The perimeter of recorded culture would therefore fall within that of the potential nature. But—one thing at a time; and it is unprofitable to think too much about what extensions or revisions of understanding the future may or may not bring.

It will be seen that the proposal is opposite to the method of Frazer and the former cultural evolutionists. Basically, they "explained"—actually, derived—certain of the more or less known phenomena of culture from the more immediately but less definitely known nature of man. I am proposing to start from the limits of known culture in the hope of finding somewhat better understanding of the undifferentiated magma of human psychic constitution.

The second approach would be a somewhat analogous inventory and methodical survey, among subhuman animals, of behavior patterns similar to or anticipatory of human cultural behavior patterns. This survey would be comparative between man and other animals; and between definitely culturally expressed patterns and predominantly congenital or individually learned patterns. These last two

ingredients, the congenital (genetic) and the individually learned, should of course be distinguished whenever possible. But the distinction is not always easy at present; and when it cannot be made, the two could still be legitimately and perhaps profitably compared jointly with human culture—which is also learned and which also expresses, however variably, a congenital constitution, but which is acquired socially and symbolically.

For instance, it is widely maintained that an element of play or playfulness enters into human and therefore cultural aesthetic, intellectual, and perhaps religious activities. A sound and critical review of the nature and range of play in the animal kingdom as well as its absences, based only on sound biological data and interpretation, would supply a firmer foundation for our understanding of the "value segment" of human culture. It might even react back on biological interpretation.

The diversity of play behavior, as between phyla, classes, and even orders, is astonishing. It may be questioned whether any invertebrates play except as part of mating. The same may hold for the cold-blooded vertebrates; but scraps of exception would be most interesting. Warm-blooded mammals play mostly in youth, but warm-blooded birds never in youth. Even adult courtship play in birds tends toward intensity and seriousness. Nonsexual play is largely confined to a few families, such as crows and magpies and again parrots.

Among mammals there are enormous differences. Insectivores and rodents play little; seals and whales possibly most of all. Primates vary—compare baboons and chimpanzees. If they play, it seems to be with accompaniment of unusual affect. Carnivores on the whole play more than herbivores; but there are contraries, such as the elephant on one side, and weasels and minks on the other. Some carnivores play until almost old age: raccoons and otters especially. The corresponding raptorial birds are playless, except for a few courtship flights.

There are many purely biological problems unsolved in this area, especially as regards correlates of greater or less playfulness: size, diet, medium inhabited, protection and sustenance provided the young, and so forth.

This extraordinary organic and phylogenetic diversity has a striking analogue in the diversity and plasticity of those sectors of culture supposedly embodying expressions or sublimations of play impulses—the "value segment" of culture already mentioned. This may be mere coincidence; but it also suggests that systematized comparison might be fruitful—even on both sides of the line that separates the organic from the organic-plus.

It seems unnecessary at this stage to do more than enumerate some of the further topics that would be relevant.

The now notorious pecking-order and the whole realm of inter-individual domi-

nance suggest much in human social and political institutions.

The societal aspects of animal life are of course of primary importance because human societies are a precondition of human cultures. Moreover socialization is one human property that has been developed to a definitely higher degree and greater integration among subhuman bees, ants, and termites—which possess certainly only exceedingly rudimentary traces of culture. It is probably significant that this inverse weighting occurs among the arthropods, a phylum very different from our own. There is excellent literature both on the social insects and on animal aggregations and societies in general, but it has certainly not been adequately exploited by sociocultural students.

The "schooling" of fishes (and birds in flight, etc.) is related to sociality but with special emphasis on kinaesthetic phenomena, and has obvious counterparts in culture and human social psychology.

Behavior related to ownership is most developed on the subhuman level with reference to space—the individual "territoriality" of many birds and some mammals and fishes. Much but not all of it is related to nesting, breeding, brooding, and nurture of the young. Certainly territorial ownership is far more widely spread, intense, and functionally significant in the subhuman area than all other kinds of ownership. Linton may therefore have been right in suggesting that human concern for property is an outgrowth of sense of territoriality. Curiously, the nonhuman primates seem to manifest rather little attachment to either places or objects.

Possessiveness toward objects has a very spotty subhuman occurrence—the presenting and stealing of pebbles by penguins, the thefts of shiny objects by crows and magpies, the hoarding of almost anything unusual by packrats, etc. Most warm-blooded species and even families seem to lack such behavior altogether; and so do probably all cold-blooded animals. When the trait does occur, its functional relevance seems weak, as if it were a selectively non-significant spill-over or "perversion" or residue from mating, breeding, home-building or food-storing patterns. It might also represent something like congenital aesthetic appreciativeness.

Home building ranges all the way from automatic secretions remaining adherent to the invertebrate body, through spun covers, cases, or webs, to elaborate constructions of extrasomatic materials by some birds and beavers. The structures may be individual or social; their function, protection of the individual or the offspring or the group. There is no close correlation with degree of total advancement: ants chiefly burrow or excavate, termites build with excretions, bees with secretions, some wasps with gathered mud or masticated cellulose. Most fish are homeless, some merely wave out a hollow or clearing for their young, but the subfish lampreys carry stones to their spawning place. Among mammals, rodents often

both burrow and assemble bedding as well as storing food; carnivores may burrow; ungulates generally do nothing at all and are homeless; a few primates make gestures toward a nest of half-broken or bent branches. The prevalence of nest-building among non-running birds is obviously associated with holding the eggs together during brooding and the fledglings during feeding, as well as with protection. As might be expected, nest-building and a sense of territoriality show a strong correlation.

Nests and structures of extrasomatic materials are of course artifacts. Beyond "housing," however, artifacts are definitely rare on the subhuman level; and so is gathering or storage of anything else than food. There are a few cases of extrasomatic uses of "tools," such as wasps tamping with pebbles, finches holding broken-off thorns to spear insects in crevices, monkeys picking up and hurling missiles. A systematic and critical evaluation of these few cases of subcultural tools might be illuminating. So would be a comparative listing of all materials, both somatic and extrasomatic, utilized extrasomatically.

Finally there are the two important fields of dance, rhythmic play, song, noise for its own sake—in short, the field of the arts in culture—and of "communication" in the wider sense—signals, sentinels, "teaching," etc. Here the findings of the von Frisch group on bee communications are outstanding and hold hope both of more results to come and of extension to other families and orders. The imitative song and speech of parrots, mynahs, mockingbirds, etc. presumably participate in both "art" and "communication," and have a further relevance of their own in that the feature of copying makes them cases of learning from the outset. If these birds learn from members of their own species as readily as from individuals of other species, as is likely but seems not proved, we have indubitable tradition at work; and therewith culture, at least of a kind. I say "of a kind" because it serves no apparent survival function, direct or indirect, but seems a matter of random amusement, playful exercise, and fitful by-products. Could it be that human culture had its first origins in analogous trivialities, and only gradually developed its seriousness and major potentialities? If not, what is the philosophic and genetic relation of the aimless and sterile "culture" of these tradition-imitating bird species to our culture? The questions are cited as illustrations of the sort of problems that the comparative subhuman inventory suggested might raise or even answer.

Similarly stimulating might be a list of behaviors that occur universally in human societies and cultures but seem universally lacking in subhuman species. Such would be: knowledge of death, concern with the future, the incest restriction, religion, extrasomatic visual art, verbal or muscular expressions of humor. Some of these might have to be modified or withdrawn, but others would presumably be

added. As the inventory consolidated and grew it might well suggest new and more precise perspectives on what factors subhuman organic evolution and human cultural evolution possessed in common and differentially.

I keep referring to inventory, review, stock-taking because I believe there is a vast body of observations, a large proportion of them critical and sound, of natural history type in the fullest scientific sense of that term, which tend to seem largely of marginal significance to most biologists as they pursue their daily work, and which anthropologists are to an even greater extent too preoccupied to utilize. In fact, the segment of anthropologists that have entered the profession from the social science side are for the most part profoundly ignorant of this class of phenomena.

I am not advocating experiment, which is difficult and too easily lets its own technique overshadow results. The value of experiment, which isolates a situation from its context in nature, is at critical points *after* these have been determined. Psychologists with rats in mazes presumably know the critical points in their problems, which I take to be theoretical and definitional, not intrinsically comparative and certainly not historical. The series of problems to which my foregoing suggestions refer are broadly historical, being concerned with evolution—the relation of cultural history to organic history. No doubt there are critical points in this field which can ultimately be clinched by experiment—von Frisch and Lorenz have demonstrated this—but the first need is for sifting of the accumulated observations to sharpen the focus on what is critical. What I have done in the preceding pages is to try to suggest some of the considerations which might guide such sifting.

That absorption of the data is the first requisite is something I feel certain of. Knowledge, factual knowledge, descriptive knowledge of form and of behavior, is what Darwin accumulated for twenty years after he found the concept of natural selection; and it enabled him in a few months to write "The Origin of Species" and establish evolution in the stream of modern thought.

I should love to participate in the adventure that I envisage and have outlined; but I must pass on the opportunity to younger bodies.

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POTTERY MASK TRADITION IN MESOAMERICA[1]

STEPHAN F. DE BORHEGYI

CLAY MASKS of various sizes representing both humans and animals have been reported in small numbers throughout Mexico. Ekholm mentions twenty-one pottery masks and maskettes from Tampico and Panuco in the Huasteca,[2] three from Guasave, Sinaloa,[3] and one from Teotihuacan, Mexico;[4] Kelly reports one from the La Carbonera site near Culiacán, Sinaloa;[5] and Drucker excavated several at Cerro de las Mesas, Veracruz[6] (see Fig. 1, map). Most of these belong to the Late Classic and Post-Classic periods, the only exceptions being some of the small maskettes from Panuco which possibly date to the Proto-Classic or Early Classic. In her recent report on the Pre-Classic culture of Tlatilco, Mexico, Muriel Porter[7] reports two clay masks which she believes to be a Pre-Classic feature unique to Tlatilco. One of the clay masks[8] from burial 79 at Tlatilco represents a human face with mouth and eye holes, three suspension holes, and which measures 13 cm in height. The other fragmentary mask[9] has decidedly feline (jaguar) characteristics, with a large mouth, drooping at the corners, and two long fangs. It came from an isolated trench at Tlatilco, has eye and mouth holes, and is 7 cm in height. It appears to have only one suspension hole. Porter also calls attention to some miniature masks excavated by Vaillant at Zacatenco, Ticoman, and El Arbolillo, which he referred to as "gorgets."[10] Vaillant has assigned these to the El Arbolillo II, Middle Zacatenco period. Although the clay masks found at Tlatilco are undeniably the earliest reported from Mexico, a specimen discovered in Guatemala appears to be of even earlier date.

1 This discussion is limited to pottery masks in Mesoamerica. No attempt has been made to incorporate Mesoamerican masks of other materials such as jade, stone, granite rock, stucco, gold, shell, mosaic, gourd, etc.

2 Ekholm, 1944, pp. 452-453, fig. 32a-g.

3 Ekholm, 1942, pp. 85-87, fig. 16a-c.

4 *Idem*, p. 87. In a letter dated March 10, 1955 Dr Ekholm informed me that the American Museum of Natural History possesses two pottery masks from Teotihuacan, Mexico. One mask has suspension holes but is without perforated eyes and is four and a quarter inches in height (no. 30.1-6918). The other has perforated eyes and no suspension holes and is five and a quarter inches in height (no. 30.1-6917). They are both of Teotihuacan V date.

5 Kelly, 1945, p. 141, pl. 4d.

6 Drucker, 1943, p. 65, pl. 43.

7 Porter, 1953, p. 25.

8 *Idem.*, pl. 13d.

9 *Idem*, pl. 13e.

10 Vaillant, 1930, pl. 39 bottom row; 1931, pl. 81, fourth row, no. 9; and 1935, p. 236.

In the course of an excavation in 1953 conducted under my direction by the students of the archaeology class of the San Carlos University Summer School, one of our laborers, Sr José Domingo Rosales, found a well-preserved clay mask representing a human face.[11] It was discovered in a bottle-shaped pit on the Las Charcas finca near Guatemala City, approximately two miles southeast of the extensive archaeological center of Kaminaljuyu. The Las Charcas site is literally covered with several hundred of these ancient bottle-shaped "rubbish" pits, similar

FIG. 1. Map showing distribution of pottery masks in pre-Columbian Mesoamerica.

(1) Tampico and Panuco
(2) Guasave
(3) Culiacán
(4) Teotihuacán
(5) Cerro de las Mesas
(6) Tlatilco
(7) Zacatenco, Ticomán, El Arbolillo
(8) Las Charcas
(9) Chipoc
(10) Coban
(11) Sanimtacá
(12) Santa Anita El Jobo

Distribution of present day mask manufacturing centers in Guatemala:

(13) Santa Cruz Chinautla (pottery masks)
(14) Totonicapán (pottery and carved wooden masks)
(15) Chichicastenango (carved wooden masks)
(16) Coban (carved wooden masks)
(17) Rabinal (gourd or calabash masks)
(18) Santiago Atitlan (carved wooden masks)

11 Guat. Mus. no. 2381.

FIG. 2. Pottery masks from Guatemala.

a, a': Pottery mask from Las Charcas, Guatemala. H: 10.4 cm. *Pre-Classic.* (see no. 8 on map).

b, b': Pottery mask from Chipoc, Alta Verapaz, Guatemala. H: 13.5 cm. *Late Classic.* (see no. 9, on map).

c, c': Pottery mask from Santa Cruz Chinautla, Guatemala. H: 15.5 cm. *Recent.* (see no. 13 on map).

in most respects to those found at Tlatilco.[12] These pits seem to have been made and used from the Las Charcas period to the beginning of the Proto-Classic period. The clay mask shown here as Fig. 2a, a′, is made of a well-polished reddish-brown ware containing a great many mica particles. This "micaceous ware" has been associated with the Las Charcas period and was used almost exclusively in the manufacture of the usually solid, handmade Las Charcas figurines. The height of the mask is 10.4 cm. It is 11.8 cm wide and the inner concavity is 2 cm deep. The eyes are represented by two slits, and six tool indentations mark the upper teeth. The individual represented by the mask has a fleshy nose, protruding lips, a small receding chin, and rather full cheeks. The facial characteristics of the mask correspond in all respects to those of the "realistic" portrait-like Las Charcas figurines. The exterior of the mask is well-polished whereas the interior is only roughly scraped and smoothed. It has two bifurcated suspension holes, one near the right temple and the other in the upper part of the left ear. It would appear that the mask was originally perforated symmetrically at both temples but that in ancient times the upper left portion of the mask broke off and the owner was forced to drill another hole. Although the mask was discovered in a pit which contained a mixed lot of Las Charcas, Providencia, and Miraflores artifacts, the micaceous reddish-brown ware of which it is made undoubtedly places it within the Las Charcas period. Since the Las Charcas culture is presumed to be older than Tlatilco, this clay mask is earlier than the Tlatilco specimens.

In Guatemala, as in Mexico, the manufacture of clay masks continued after the close of the Pre-Classic or Formative horizon. Although rare, they are present in the Late Classic period and are most common in the Alta Verapaz region. There are seven large clay masks representing human and grotesque faces in the Dieseldorff collection in the Guatemala Museum.[13] Of the seven, five have eye, mouth, and suspension holes, while the remainder have only mouth and suspension holes. They were found by the late E. P. Dieseldorff during his excavations in the vicinity of Cobán, and in the Sanimtacá cave, Alta Verapaz. Some of the grotesque faces show distinct feline and serpent characteristics. Since the specimens in the Dieseldorff collection were not uncovered during controlled excavations, it would be precarious to try to date them, were it not for an almost identical mask[14] from Chipoc, Alta Verapaz (see Fig. 2b, b′). This fragmentary specimen was excavated by R. E. Smith of the Carnegie Institution in 1944, and the associated material indicates it to be of Late Classic date.[15] It is made of a superficially smoothed and

12 Porter, 1953, pl. 1b; also see Shook, 1951, p. 96.

13 Dieseldorff, 1926, vol. 1, table 7, nos. 25 and 26; Villacorta and Villacorta, 1930, p. 349; and Guatemalan Museum Guide book, 1948, p. 8, figure in upper left corner.

14 Guat. Mus. lot no. C-48.

15 See R. E. Smith, 1952.

unpolished orange ware. The interior of the mask is also unpolished. The sharp "eagle" nose is perforated and the mouth open. Five sharp tool marks beneath the upper lip indicate teeth. When complete it may have shown ten to twelve teeth. Above the eyes there are narrow slits, probably to enable the wearer to see. The height of the mask is 13.5 cm and the width of what remains of the face is 9 cm, suggesting an original width of approximately 18 cm. Above the left ear are two suspension holes indicating that originally there were four holes, two over each ear.

In the Guatemala Museum collection there is another Late Classic mask.[16] Although fragmentary it clearly represents an aged human face and is of the miniature type (4 cm high). It is from Santa Anita, El Jobo, in the Department of Santa Rosa. It has three suspension holes.

No examples of clay masks have yet been found from the Post-Classic period in the southern Maya area but Kubler illustrates two clay masks in the Arensberg collection from central Mexico.[17] The larger specimen is 13.5 cm high, while the smaller one is only 5 cm in height. Both have eye and mouth holes and large upturned noses. They also have intricate linear markings suggesting face painting or tattooing. Kubler believes that the upturned nose may represent an Aztec caricature of their Huaxtec neighbors. Anthropomorphic effigy vessels, ladle censers, and incense burners with similarly upturned-nosed individuals are characteristic however of the Post-Classic period in Guatemala,[18] and therefore the suggestion that they represent caricatures of the Huaxtecs is open to doubt. Probably they represent some manifestation of the long-nosed rain god. The green or black stone mask-like heads or "amulets" with upturned noses from Nebaj, Oncap, Chipal, and Zacualpa in the northern and southeastern Quiche region, may represent the Guatemalan counterparts of the clay masks illustrated by Kubler. They are usually small, 4 to 7 cm in height, and many have bifurcated suspension holes.[19]

The manufacture of clay masks continues today in Guatemala. In Figure 2*c*, *c'* I illustrate a typical example of the pottery masks made in the village of Santa Cruz Chinautla, a small Pokoman Indian town about twelve miles northeast of Guatemala City. The Chinautla handmade pottery is probably the best known and best executed pottery in Guatemala today. The well fired and beautifully painted Red-on-white, White-on-red, and plain yellowish-orange ware jars, bowls, pitchers, and effigy whistles are favored by many Indian housewives and are carried by the native merchants to all parts of Guatemala.[20] These modern pottery masks, although not made in any quantity, are interesting examples of the artistic

16 Guat. Mus. no. 4053.
17 Kubler, 1954, figs. 25, 26.
18 R. E. Smith, 1952, fig. 26a; Smith and Kidder, 1951, figs. 79a, 90.
19 See Smith and Kidder, 1951, p. 44, figs. 53a, 89 and 90a; Lothrop, 1936, p. 59, fig. 62.
20 R. E. Smith, 1949.

expression of the Chinautla potters. The specimen illustrated here is 15.5 cm high, 13.5 cm wide, and has an inner concavity 4.5 cm deep. It has eye and mouth holes made in the form of narrow slits. It is made of the regular Chinautla yellowish-orange ware, is well fired, and is polished on the exterior. The interior is unslipped and unpolished. The prominent nose is pinched together at the tip. The chin is protruding and nine tool marks indicate the teeth. The curly moustache is applied and shows ten tool indentations on each side of the nose. The eyebrows and eyelids are represented by tool marks. The masks usually have three suspension holes punched from the exterior. The pottery masks from Chinautla are used in Chinautla and elsewhere in the Guatemalan highlands to cover the faces of Indian dancers during festival ceremonies. Masks with moustaches usually represent Spaniards, and are used in dance dramas in which the conquest of Guatemala by Pedro de Alvarado is reënacted. Since the head of the dancer is swathed in scarves the size of the actual mask does not have to be great.

From the above it is obvious that clay masks, although they have not been found in quantity, must have been in continuous use throughout Mesoamerica from the Formative period to the present. The purpose for which the pre-Columbian masks were used and by whom they were worn is still an open question. The eye and mouth holes on the larger specimens suggest that they were true, i. e., functional, masks in contrast to the many jade, granitic rock, and limestone mask-like "face-panel" carvings so common in central Mexico, especially in Teotihuacan and Guerrero.[21] The fact that the pottery masks were occasionally made in miniature complicates the problem. Possibly these were simply representations of the real masks, and since most of them have suspension holes, they may have been worn as amulets, pectorals, or pendants. Miniature (4 to 6 cm high) brightly painted pottery and wooden masks are still manufactured in Guatemala in the towns of Chichicastenango and Totonicapán.

On stela 11 at Yaxchilan, Chiapas, Mexico, tattooed prisoners are represented with bound arms kneeling before an elaborately clothed priest who wears the mask of the Sun God.[22] This stone carving, dating about 752 AD, suggests that masks were worn by priests, possibly to conceal their identity and inspire fear among the uninitiated. Perhaps the larger pottery masks found among archaeological collections were used for similar purposes. We know that among the Aztecs masks were often used in temple ceremonies when a god was impersonated. In many of the *codices* even the gods are sometimes represented wearing masks. For example when Quetzalcoatl appeared as Ehecatl, god of the wind, he was pictured wearing a red mask, which resembled a bird's beak, while Mixcoatl usually was represented with a black mask. Certainly masks must have played an important

21 Kubler, 1954, figs. 15-23, 87-89, 93, 109, 119.
22 Thompson, 1942, pl. 3, and 1954, fig. 15.

part in pre-Columbian rituals and may have represented gods, spirits, deified heroes or even totem animals and *nahuals*. The practice of making and wearing masks is a nearly universal preoccupation of mankind.

Masks also may have been used to intensify the religious feeling in a community and to permit escape from the burdens of reality into a world of mystery and drama. Such seems to have been the object of the masked dancers on the Bonampak murals.[23] The inevitable accompaniment of any feast day among the present day Mayas of the Guatemalan Highlands is a masked dance drama. Although the masks used for these dances are in most cases made of carved, richly painted or gilded wood and represent many post-Columbian features,[24] there is no doubt of their pre-Columbian affiliations. It is interesting to note in this connection that the present centers of pottery, gourd, or wooden mask manufacture (Chinautla, Chichicastenango, Totonicapán, Cobán and Rabinál) coincide closely with the pre-Columbian distribution of pottery and stone masks in Guatemala. A good case for the regional mask manufacturing tradition as a cultural continuum is therefore evident (see Fig. 1).

Mention should be made, however, of two other uses for masks in the southern Maya area. *Effigy masks* to cover the faces of a "scarecrow" type of image with sacred connotations, such as "Maximon," "Judas," etc. are made in several villages in the Guatemalan Highlands, most notably Santiago Atitlan and San Pedro La Laguna.[25] These are distinguished from the ordinary dance mask by the lack of eye slits and mouth openings, although a small hole may sometimes be carved between the lips for the purposes of inserting a cigar or cigarette. Some of the pre-Columbian masks without eye holes may also have been used to cover the faces of sacred images or idols. As a matter of fact there are several references to "masks of wood" in connection with idols in the testimonies taken at the time of the *auto de fe* and the investigations regarding idolatry in 1562 in Yucatan.[26] Other masks, especially the "face-panel" type, either with or without eye holes, were very probably used in pre-Columbian Mesoamerica as *death masks*. They may have been put over the face or attached to the outside of the bundle containing the dead person as was frequently done with the mummy bundles of ancient Peru. The fact that some of the pottery, stone, or jade masks actually were discovered in burials, would seem to corroborate this theory.

In summary, the following four categories of pre-Columbian pottery and other masks can be suggested for Mesoamerica in accordance with their size and function: (1) True mask; (2) Effigy mask; (3) Death mask; (4) Pendant mask.

23 Thompson, 1954, pl. 17b.
24 Lothrop, 1927, figs. 25, 26, 28, 29; Lothrop, 1929, figs. 1, 2.
25 Lothrop, 1929, figs. 9, 11.
26 See Tozzer, 1941, pp. 77, 103, 111.

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A SUGGESTED CHRONOLOGY FOR SOUTHERN CALIFORNIA COASTAL ARCHAEOLOGY

WILLIAM J. WALLACE

INTRODUCTION

SOUTHERN CALIFORNIAN PREHISTORY has never occupied a prominent place in North American archaeological researches, and there is not a very imposing literature on the subject. This is despite the fact that much archaeological work has been done by local educational institutions, museums, and interested amateurs. Many localities have been searched for evidences of human occupation and a fair number of sites have been dug, some with a degree of completeness, but publication has lagged far behind survey and excavation. As a consequence, the characteristics of the prehistoric cultures and their sequence in time are but vaguely known. Enough information exists, however, to provide a basis for a few tentative statements concerning cultural development.

Southern California, which includes approximately one-third of the state, can be separated into a western or coastal province and an eastern or desert zone. These subareas are distinct geographically and, in the light of present archaeological knowledge, culturally, though there is some overlapping. Only the coastal region, including Santa Barbara, Ventura, Orange, and the non-desert portions of Los Angeles and San Diego counties, will be discussed here.

THE COASTAL PROVINCE

Stretching from Point Conception southward to the Mexican border, the coastal province comprises a broad strip of broken land along the sea and inland for some miles. A complex network of mountain ranges, 5000 to 7000 feet high with peaks much higher, separates it from the deserts of the interior. The year-round climate is mild with small daily and annual ranges because sea breezes and fogs tend to stabilize the temperatures, without extremes. Year averages are from 65° in January to 70° in July, with a greater range in the intermediate and interior valleys. The year divides in general into two seasons—wet and dry—with nearly all the rains falling in the months from October to May. Annual precipitation varies from eighteen inches at Santa Barbara to about ten inches at San Diego. Summer is a period of drought.

The streams and rivers of Southern California carry little or no water during most of the year. Large flows come only during heavy winter rains and taper off

soon afterwards. Springs and small perennial streams in the canyons provide the water supplies.

The dominant woody vegetation is not trees but the almost impenetrable chaparral. Foothills, interior valleys, and canyons are characterized by groves of oaks, while sycamores and willows grow along the stream beds. Large areas are grass- and shrub-covered, particularly in the inland valleys behind the coastal hills. A real forest growth occurs only in the dividing mountains where pines, firs, and cedars are found.

Large land mammals are not abundant, being represented only by the California mule deer and in some localities by the American antelope. Small mammals are numerous, however, with several species of rabbits and many of squirrels, rats, and mice. Carnivores include foxes, coyotes, raccoons, skunks, and badgers. Wild cats and mountain lions are occasionally seen. In the coastal waters are various sea mammals—seals, sea lions, dolphins and the like. Sea otters formerly abounded. Bird life is varied and profuse with many land and marine species. There are ample resources of fishes and shellfish.

The coastal strip, with its pleasant climate and more than adequate plant and animal food resources, was favorable for aboriginal occupation and contained a heavy population estimated at over 20,000. Most of the native peoples—collectively referred to as the Mission Indians because they were quickly taken to the Franciscan missions by the Spaniards and Christianized—spoke languages of the Shoshonean family. Included were the following groups: Gabrielino, Cupeño, Nicoleño, Juaneño, Luiseño, most of the Fernandeño, and some of the Cahuilla. Non-Shoshoneans were the Hokan-speaking Chumash or Canaliño of the Santa Barbara region and the Yuman Diegueño in the southwestern section of the state. The Mission Indians shared essentially one basic culture though there were some regional differences. Most of the coastal tribes are now extinct or nearly so. Abundant traces of the former presence of the historic peoples and their predecessors, survive, however, in the numerous and easily discernible habitation sites.

Archaeological evidence now suggests a classification of these remains into four broad temporal divisions or horizons: an initial period of "early man" finds; a long "milling stone" phase; a little known intermediate period; and a late manifestation including historical materials and what appear to be their immediate prehistoric antecedents. These wide and rather vague divisions do not reflect detailed cultural-historical changes with accuracy but they do provide a framework in which to discuss the data.

HORIZON I. EARLY MAN

There is little positive evidence concerning the earliest peopling of the Southern California coast. Quite recently claims have been made for a Third Interglacial

occupation.[1] These are based upon the recovery of fractured stones from the silts and gravels of river and ocean terraces in the San Diego area. There is no convincing proof that these random finds are artifacts. True, they all show percussion flaking but natural forces can produce chipped edges on rock as well as man. Until supporting evidence is offered, these stones cannot be accepted as conclusive evidence of man's presence in this remote period.

Three finds of human skeletal material have been made in the city of Los Angeles under conditions which suggest some antiquity. During the construction of a storm drain in the Ballona Creek area in 1936, human bones were recovered twelve to thirteen feet below ground surface in a geological stratum attributed to the Pleistocene.[2] In the same layer, but not in direct association, were bones and two teeth of a mammoth (*Archidiscodon imperator* Leidy). The remains of "Los Angeles" man consisted of a cranium and seven fragments of other bones, all heavily fossilized. The fluorine content of the human and elephant bones is quite similar, presumably indicating contemporaneity.[3]

At least six human skeletons were uncovered nineteen to twenty-three feet below the surface, during construction in the Angeles Mesa district in 1924.[4] The osseous material was not scattered, all coming from an area of not more than twelve square feet. Some bones show considerable mineralization; in other cases the replacement is not so great. The deep occurrence of the skeletons and a lack of evidence of disturbance of the overlying deposits precludes the possibility of recent burial. Presumably the remains were deposited before the nineteen to twenty-three foot overburden was laid down. No bones of Pleistocene or Recent mammals were secured from the sand and sandy silt in which the human material lay. A quartzite boulder, regarded as an implement, and a small awl-like object were recovered, however.

The famed asphalt deposits of Rancho La Brea, containing a record of life extending from a stage somewhere in the Pleistocene (probably Last Interglacial) into Recent times, has also yielded human remains. An almost entire skull and some other portions of the skeleton were encountered in Pit 10 at depths extending from approximately six to nine feet.[5] The associated mammals and birds were for the most part more characteristic of the present time than of the Pleistocene, though some Ice Age forms were included. Judging from the accompanying faunal remains the human skeleton would belong to the early Recent epoch or not earlier than the very latest portions of the Ice Age. Purely geological evidences of age

1 Carter, 1950, 1952, 1954.
2 Lopatin, 1939.
3 Heizer, 1951, p. 7.
4 Stock, 1924.
5 Merriam, 1914; Stock, 1942.

are generally exceedingly difficult to obtain in asphalt deposits, owing to the peculiar manner of their accumulation and the possibility of movement in the deposit after they are formed.

These finds have received little consideration, primarily because they were made during a period when skepticism of all "early man" discoveries still prevailed.[6] The skeletal remains and the circumstances of their recovery should be reëxamined. Careful cranial reconstructions and measurements need to be made. It would be of great interest, for example, to see how the skulls compare morphologically with types believed to be very early arrivals in the New World. With the possible exception of Los Angeles Man, the present evidences do not point unequivocally to Pleistocene age. They do indicate, however, that they considerably antedate the present and that, if not of Ice Age antiquity, they at least fall in an early phase of the Recent epoch.

There are also a few artifacts which point to man's living along the coast of Southern California in remote times. Traces of man's presence at Rancho La Brea are not limited to the skeleton from Pit 10. Scattered objects of human manufacture have been recovered in another pit from which a more ancient fauna has come.[7] A series of fifteen artifacts of bone, stone, and shell were found in excavation unit 61-67 (which began as two separate pits but merged into one) at depths of from eight to eighteen feet. Most of the items are of types which have no known diagnostic significance. Four, however, all apparently from the same general depth and area, appear to be of old forms unknown in late coastal sites. Three are broken sections of heavy wooden dart foreshafts. The fourth is a more complete specimen, a wooden bunt foreshaft, again presumably for a dart. It is quite possible that these belonged to late Pleistocene or early Postglacial hunters who preyed upon animals trapped in the sticky asphalt.

Also attributed to Late Pleistocene or Early Post-Glacial times are archaeological remains from Level 1 at Malaga Cove and from San Dieguito campsites. Malaga Cove is a large site on a high cliff overlooking Redondo Beach in Los Angeles county. Four physical and cultural levels have been distinguished.[8] In the bottommost (Level 1), a compact yellow stratum, was found an unusual and simple assemblage in which the distinguishing items were microliths. Included also were flake knives, convex-based projectile points (two only), flake scrapers, chipped core and pebble hammerstones, abalone shells with openings plugged with asphaltum, spire-lopped Olivella shell beads, clamshell disk beads (rare), scored and incised stones, bone points, bone harpoon barbs (projectile tips?), bone spatulae, and bone beads. The uniqueness of this assemblage is emphasized by the

6 Cf. Hrdlička, 1937, p. 99.
7 Woodward, 1937.
8 Walker, 1951.

apparent absence of seed-grinding implements so characteristic of Californian archaeological sites. The early people subsisted largely by shellfish-gathering, supplemented by some hunting and fishing. There is no concrete evidence of plant-collecting. No human skeletal remains were uncovered, so that information on disposal of the dead is lacking. Level 1 materials lie in the upper three feet of a 25-foot, non-marine Pleistocene terrace. If humans lived at Malaga Cave during the deposition of this last three feet, presumably they were there during the late Pleistocene. The associated fauna, however, includes only one extinct species, a diving goose. The archaeological sampling is such a meager one that additional excavation is needed before any certain conclusions can be drawn concerning this occupation.

San Dieguito represents a distinctive and widespread chipped stone industry distributed from the Pacific shores to the Colorado River and beyond.[9] Typically sites are situated on mesas or hilltops and contain no occupation refuse other than stone objects. All of the lithic material occurs upon the surface or slightly below. The fundamental elements of this assemblage are: numerous scrapers and scraper planes, choppers, "amulets" or "ceremonial stones" (small chipped and notched crescents), large blades and points. The last three are far from abundant. There is some question whether milling stones and mullers form part of the complex.

An age of 1200 BC (or Little Pluvial) was originally assigned to the San Dieguito complex. A greater antiquity has been suggested because of the occurrence of remains on ancient land forms such as elevated marine terraces and inland around the margins of extinct lakes.[10] The general simplicity of the materials has also been taken as a criterion for an earlier placement in time. Dating has recently been confused by a revision downward of the cultural sequence for the Colorado River basin where several phases of San Dieguito are recognized. This was done on the basis of a review of collections from the occupational layers in Ventana Cave.[11] Early San Dieguito remains are now recognized in the Ventana complex, which brings them into chronological agreement with Folsom. This cultural and temporal equation rests on the common possession of a relatively few classes of simple percussion tools and needs to be demonstrated more convincingly. If the dating is accepted, it would push the beginnings of the coastal manifestation farther back in time. The San Dieguito complex is assumed to have endured much longer in the west than in the arid interior and to have passed through several distinct phases with the last (San Dieguito IV) persisting in Baja California until about 900 AD.[12]

9 M. J. Rogers, 1929, 1938, 1939.
10 Treganza, 1947.
11 Haury, 1950, p. 531, fig. 115, p. 533.
12 M. J. Rogers, 1939, plate 21.

HORIZON II. MILLING STONE ASSEMBLAGES

A fairly adequate archaeological record exists for a group of lithic assemblages which appear to follow the above in time. These are characterized by the extensive use of milling stones and mullers. There is also a general lack of well-made projectile points. The few points which have been found are often leaf-shaped and of a size to suggest that they were used to tip darts propelled with the throwing stick. Bone tools and shell items are scarce or absent. No containers for storing and cooking food have been recovered. It is probable that these were of basketry and have left no traces in the archaeological deposit. The early people were primarily food-collectors, with hunting and fishing definitely in a secondary role. Mammal, bird, and fish bone refuse is scarce in the deposits. These early coastal inhabitants appear to have been more or less sedentary, as the size and depth of some of the sites suggests a long-continued occupancy of the same locality.

The Oak Grove culture of the Santa Barbara region is the best-known representative of this horizon.[13] Similar assemblages have also been unearthed at the Little Sycamore shellmound in southwestern Ventura county,[14] at Topanga Canyon just north of the city of Los Angeles,[15] in Level 2 at Malaga Cove,[16] and in the La Jollan shellmounds of San Diego county.[17] Distinctive traits are summarized in Table 1.

In addition, the Porter Ranch site at San Fernando probably should be included in this horizon.[18] Here a vast concentration of milling stones was uncovered along with a few handstones. The remaining artifacts consisted of a flaked stone knife blade with a convex base, two large projectile points—one leaf-shaped and the other stemmed and corner-notched—a stone discoidal, one mortar, and several "problematical stones." A few burned mammal bones and a single human re-burial were also found. The deposit did not give evidence of the existence of a village and is assumed to represent a ceremonial site.

Comparable milling stone assemblages have also been unearthed at Point Dume (Zuma Creek, Site A) on the Los Angeles county coast, and at Encino (LAn 111) in the San Fernando valley. None has yet been unearthed in Orange County though the lower level (Culture 1) of the Goff Island site may represent this horizon.

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13 D. B. Rogers, 1929; Orr, 1943, 1952.
14 Wallace, 1954; Wallace and others, n.d.
15 Treganza and Malamud, 1950.
16 Walker, 1951, pp. 51-60.
17 M. J. Rogers, 1929, 1939; Harding, 1951.
18 Walker, 1951, pp. 15-26.

TABLE 1

Milling stone horizon cultural assemblages

	Oak Grove	*Little Sycamore*	*Topanga*	*Malaga Cove (Level 2)*	*La Jolla*
Subsistence	Seed-collecting	Shellfish and seed-collecting	Seed-collecting	Shellfish and seed-collecting	Shellfish and seed-collecting
House type	Circular pit-house	Unknown	Unknown	Unknown	Unknown
Grinding implements	Mullers-milling stones, few mortars pestles	Muller-milling stones, few mortars pestles	Mullers-milling stones, few mortars pestles	Mullers-milling stones, few mortars pestles	Mullers-milling stones
Stone projectile points	Few, large and crude	Few, large and crude, mainly leaf-shaped	Few, large and crude	Absent?	Few, large and crude
Other chipped stone tools	Large blades (leaf-shaped rounded base), retouched flakes	Retouched flakes, few core tools	Abundance of flake and core tools	Knife blades	Retouched flakes, beach cobble choppers
Bone objects	Rare or absent	Few in number	Few in number	Present (no description)	
Ornaments	Absent	Few spire-lopped Olivella beads	Few clamshell disk beads, slate pendants	Shell ornaments, bone beads	Few spire-lopped Olivella beads
Mortuary complex	Extended burial, rock cairns over corpses, few grave offerings, red ocher abundant	Flexed burial, reburial, rock cairns over corpses, few grave offerings, little red ocher	Extended burial, reburial, rock cairns, over corpses, few grave offerings	Reburial, rock cairns over corpses	Flexed burial, rock cairns over corpses, few grave offerings
Special features		Stone discoidals, pitted hammerstone	Stone discoidals and cores, pitted hammerstones	Stone discoidals, steatite objects	

There is some diversity in the local expressions as, for example, in the non-utilization of shellfish resources by the Oak Grove and Topanga peoples. Also the multitude of forms of rude flake- and core-tools from Topanga is not duplicated elsewhere. The resemblances overweigh the differences however, and seem to indicate that the assemblages constitute a basic cultural stratum. Actually the similarities may be greater than indicated as the data are not very complete. Various authors have pointed out possible relationships with similar assemblages in the interior of California and to the Cochise culture and other early lithic complexes in the Southwest.

The antiquity of the milling stone assemblages cannot be expressed in exact dates as no radiocarbon analyses have been made. Although the remains are definitely post-Pleistocene, none having been found with convincing evidences of a climate, fauna, or flora demonstrably different from that of the present, they do give indications of respectable antiquity. Signs pointing to an early dating are: the metamorphosed nature of the archaeological deposits; the semi-mineralization of human skeletal material; and the general simplicity of the remains. Estimates of time are hard to make in the absence of specific dates, yet to allow 4500-5000 years for the beginning of these simple cultures and 2000-3000 years for their duration does not seem excessive.

HORIZON III. INTERMEDIATE CULTURES

An impressive gap lies between the milling stone assemblages and the rich and elaborate artifact inventories of the late prehistoric period. This "gap" does not imply that the Southern Californian coast was uninhabited for some hundreds or thousands of years, rather it indicates a lack of knowledge of what occurred during the intervening years. Archaeological remains dating from this period have either not been recognized or described. The paucity of well-stratified sites has been a handicap here.

In the Santa Barbara region the Hunting Culture lies intermediate in time but seems to show few specific relations either to the preceding or following cultures.[19] The Hunting people introduced the basket-hopper mortar, mortar, and pestle. Chipped stone implements are more diverse and plentiful, with broad leaf-shaped blades and heavy, often stemmed, projectile points being characteristic. Bone and antler objects though present are far less numerous and varied in form than in subsequent phases. Personal ornaments are few, consisting of massive beads of bone and shell. Asphalt and steatite were occasionally used. No traces of dwellings have been observed. The Hunting people customarily interred their dead in a flexed posture, face down, with the head to the west. Red ocher was spread over corpses and rocks were heaped up over them.

19 D. B. Rogers, 1929, pp. 356-366; Orr, 1943, p. 34, 1952.

In contrast to their predecessors, the Hunting people, as their name implies, were primarily dependent on wild game. Land mammal bones are plentiful in their village refuse. There is also a fair proportion of sea mammal remains but only a few fish bones. Quantities of sea shells scattered through the debris give an indication that shellfish contributed heavily to this people's diet.

The Sand Dune site (USC-Ven 2), just across a small creek from the Little Sycamore "milling stone" site, yielded evidences of a rather simple complex characterized by numerous pestles and a few mortars.[20] These may have been the only seed-grinding devices employed as there was an apparent absence of milling stones and mullers. Projectile points are heavy and characteristically stemless, though a few small specimens are included. Bone implements, mainly awls, were present in some numbers. Articles of personal adornment were disk-shaped and spire-lopped Olivella beads. No information on mortuary practices was obtained. The prehistoric population maintained itself by collecting shellfish and wild vegetable foods, supplementing their diet quite often with fish and wild game.

An archaeological site at Big Tujunga Wash in the San Fernando valley may also be included in this horizon.[21] Many hundreds of fragments of stone bowls were turned up. Mortars, pestles, and handstones were also obtained. Also present were several forms of large projectile points, flaked stone blades, bone awls, and beads of Olivella shells. These items are roughly analogous to the classes of artifacts from Hunting settlements and the Sand Dune site. Included in the Big Tujunga inventory were a series of objects generally regarded as somewhat more recent, namely containers, tobacco pipes, and beads made from steatite, mortars with flat bases and flaring sides, and a few small points. None of the latter, however, are typical late forms. Two separate methods of disposal of the dead appear to have been practised by the Tujunga population: reburial under stone cairns and cremation. About forty Hohokam sherds, apparently all from a single vessel, have been dated between the 7th to 9th centuries AD.

For San Diego county the La Jolla culture is assumed to have persisted with little change. During a later phase (La Jolla II),[22] chipped stone tools increased in quantity and variety but the mortar-pestle grinding assemblage is not reported. La Jolla II is assumed to have merged with Diegueño, the last prehistoric phase.

Excluding San Diego county, the major cultural change during this period, aside from an increased dependence upon hunting, was the shift in grinding implements from the milling- and hand-stone combination to the mortar-pestle, though the former continued in use on a reduced scale. This may signify a change in food

20 Wallace, n.d.
21 Walker, 1951, pp. 102-116.
22 M. J. Rogers, 1945.

habits or emphasis from hard-shelled seeds to larger fleshier fruits such as the acorn, the great staple of the historic California Indians. Mortars and pestles are regarded as being more efficient for pulverizing and grinding oily and fleshy acorns preparatory to leaching out their tannic acid content. This superseding of one set of grinding tools by another is duplicated elsewhere in California. The milling stone and muller apparently were kept because they filled a special need.

The prehistoric peoples seem to have used the bow and arrow, at least occasionally. Judging from the size and weight of the majority of their projectile points, they continued to cast darts with the throwing board. The fair number of bone awls suggests the manufacture of coiled basketry, though the sharp-tipped bone implements may conceivably have served some other purpose.

For the present these "intermediate" complexes cannot be arranged in a chronological sequence one to the other, though age differences between them seem apparent. For instance, the Tujunga materials appear to be somewhat more recent. All that can safely be said is that they fall in time somewhere between the milling stone and late horizons. Any attempt to set definite temporal boundaries is entirely guesswork but a span of time between 1000 BC–0 AD and 1000 AD appears to be well within the bounds of probability. As in the preceding phase, cultural growth progressed at a slow rate. Information is badly needed for this chronological period.

HORIZON IV. LATE PREHISTORIC CULTURES

The Late pattern of life along the Southern California coast is more complex, with many more classes of artifacts present which in general show a high order of workmanship. There appear to be a number of distinctive local complexes but all share certain traits, most of which were known to have been present at the time of European penetration. Important new developments include: increased use of the bow and arrow (as inferred from the abundant presence of small finely chipped projectile points), stone projectile tips characteristically stemless with either a concave or convex base, steatite containers, pottery vessels (in the south), circular shell fishhooks, perforated stones, generous use of asphalt as an adhesive, bone tools many and varied, numerous personal ornaments of shell, bone, and stone, and elaborate mortuary customs with abundant grave goods. The population seems to have increased as settlements are more extensive or perhaps small local groups joined together to form larger villages. There was a greater utilization of available food resources with more land and sea mammal hunting and fishing, along with a continued interest in collecting.

The Canaliño culture of the Santa Barbara channel region, divided into three developmental phases, was the most elaborate of the late coastal manifestations

and marks the peak of California Indian culture.[23] It is evident that material culture in practically all of its phases underwent an independent, special, and uncommon development here, which is displayed in an unusual wealth and variety of industrial and artistic forms. The Channel Islands offshore may have received their first occupation at this time, though there is no agreement on this point. The Canaliño culture extended southward into Ventura county (Point Mugu site) and into western Los Angeles county (Arroyo Sequit site), localities well within the boundaries of the territory of the historic Chumash or Canaliño. Material culture was no respecter of linguistic and ethnic boundaries, however, as quite similar materials have been uncovered farther south in territory occupied in the historic period by Shoshonean-speaking peoples. A like complex is present in Malaga Cave in Level 4 and probably also in Level 3. Although these two strata are separated and regarded as distinct cultural entities, they appear to have much the same content. Except for the lack of a few classes of traits (arrow points, painted pebbles, basket hopper mortars, flexed burials), Level 3 is much like the overlying area. These absences may well be due to chance circumstances of excavation. A site at Long Beach (Los Altos 1) and several on or near the coast of Orange county have also produced this type of culture. A rock shelter in the Simi valley, Los Angeles county, gave evidence of late occupation.[24] The number of artifact classes here was small, as this was a temporary stopping place rather than a permanent settlement.

Farther south in San Diego county late manifestations have been reported from a number of localities: Diegueño sites on the coast,[25] Site 7 on the north bank of the Santa Margarita River in the Fallbrook region,[26] the San Vicente Creek site, four miles north of the village of Lakeside,[27] and at SD-132, just west of Pala and a few miles inland from the Pacific Coast.[28]

Table 2 lists the characteristic items occurring in some late sites. Although all share basic traits, a distinction is noticeable between the northern and southern (San Diego county) sections in grinding implements, containers, mortuary practices, and to a lesser extent in the form of projectile points. Portable stone mortars and pestles, along with the basket-hopper slab, continue to be the dominant grinding implements in the north, whereas bedrock mortars and a more extensive employment of the milling stone appears at the San Diego county sites. Pottery vessels are few in number north of the Orange county line. Competition with steatite

23 D. B. Rogers, 1929; Orr, 1943, 1952.
24 Shiner, 1949.
25 M. J. Rogers, 1945.
26 McCown, 1948.
27 McCown, 1945.
28 Meighan, 1954.

TABLE 2

Late Horizon Cultural Assemblages

	Canaliño	*Malaga Cove (Level 4)*	*San Luis Rey I Complex (S.D. 132)*	*San Vicente Creek*	*Fallbrook Area (Site 7)*
Subsistence	Shellfish- and seed-collecting, hunting, fishing	Shellfish- and seed-collecting, hunting, fishing	Seed-collecting, some hunting	Seed-collecting and hunting	Seed-collecting, some hunting
House form	Circular	Unknown	Unknown	Circular	Circular, rock-paved area
Grinding implements	Mortars-pestles	Mortar-pestle, basket hopper mortar	Bedrock mortars-pestles, milling stones-mullers rare portable mortars and bedrock milling stones	Bedrock mortars, milling stones, mullers	Bedrock mortars, pestles, milling stones, mullers
Stone projectile points	Small, stemless concave and convex-base	Small, stemless concave and convex base	Small, stemless, concave base dominant	Small, stemless, concave base	Small, stemless, concave base
Other chipped stone tools	Drills, knife blades	Drills, knife blades, scrapers	Drills, scrapers	Flake scrapers	Drills, flake scrapers
Bone objects	Numerous, awls, ornaments	Numerous	Fairly numerous, awls, flakers	Not numerous, awls	Not numerous, awls, scrapers (?)
Ornaments	Numerous shell and stone beads, pendants	Numerous shell beads, bone beads	Shell beads (disk and spire-lopped Olivella), stone pendants	Shell beads (spire-lopped Olivella), disk (Olivella?)	Shell beads, spire-lopped Olivella
Mortuary complex	Flexed burial	Flexed burial, rare cremation		Cremation, bones often placed in pottery vessels	Cremation
Special features	Charmstones, steatite vessels, extensive use of asphalt, shell fishhooks	Steatite vessels, extensive use of asphalt, shell fishhooks, glass trade beads, painted pebbles		Pottery vessels and pipes	Pottery vessels and pipes, steatite arrow-straightener

containers, which are equal to pottery in every respect and can be used directly over the fire in cooking, may have hampered the spread of the potter's art northward, though knowledge of the craft may still have been spreading at the time of Caucasian entry.[29] Whereas the predominant mortuary practise in the northern section remained flexed burial, cremation was practised in the south at least during the closing phase of the prehistoric period. Both the knowledge of ceramics and cremation appear to have diffused into the San Diego area from the arid interior. The convex-based point, though not unknown in the south, occurs in reduced numbers. Curved shell fishhooks have not been reported beyond the Orange county line though at least occasional specimens have been recovered much farther south.

The late period sites are not all chronological equivalents but they can be placed within a time span from about 1000 AD to contact times. Throughout this period there appears to have been a definite cultural lag in the southern part of the region, despite such innovations as pottery and cremation. The present dating of late sites appears to be a little conservative. The placing of the first appearance of the Diegueño culture in the 15th century[30] and San Luis Rey I (S.D. 132), regarded as essentially pre-ceramic, in the period between 1400-1750 AD,[31] seems too moderate and does not allow enough time for subsequent cultural-historial developments.

The coming of the Spaniards to the California coast during the last third of the eighteenth and the first third of the nineteenth century and the removal of the native peoples to the missions brought the aboriginal period to a close. The Indians suffered greatly from missionization and their cultures quickly collapsed. As a consequence there are few sites in the coastal strip belonging to the period of contact with Western civilization when Indian and White lived side by side.

SUMMARY AND CONCLUSIONS

Regional sequences as now conceived for the Southern California coast are summarized in Table 3. Correlation between the various localities is replete with difficulties, and the chronological placement of sites and complexes has been arrived at by rather broad typological comparisons and guesswork, only occasionally from archaeological stratigraphy. The whole scheme suffers from a lack of reliable dates, so that the complexes included in the same level can be regarded only as approximate time equivalents.

Though the primary concern is with sequence, estimates of age and duration are included. These are admittedly estimates which probably will change radically

29 *Idem*, p. 222.
30 M. J. Rogers, 1945.
31 Meighan, 1954.

TABLE 3

Regional Sequences in Southern California Archaeology

Date	*Santa Barbara County (northernmost)*	*Ventura County*	*Los Angeles County*	*San Diego County (southernmost)*	
				Inland	*Coastal*
	III Canaliño II I	Canaliño (Point Mugu)	Canaliño (Arroyo Sequit) Malaga Cove IV (Probably also III)	San Luis Rey I San Vicente Creek Fallbrook	Diegueño
1000					
	Hunting	Sand Dune	Big Tujunga	La Jolla II	
AD BC					
	Oak Grove	Little Sycamore	Malaga Cove II Topanga	La Jolla I	
3000					
			Malaga Cove I La Brea Angeles Mesa Los Angeles Man	San Dieguito	

with new evidence. As regards more reliable dates nothing constructive can be offered as none has yet been provided by C14 samples.

A broad interpretation of the archaeological record indicates a more or less parallel development in the several localities. Following a scantily-represented and ill-defined early phase, there was a period in which the peoples lived primarily by gathering and made use of milling stones and mullers. The remainder of their material equipment was meager and crude. They were replaced in time by populations preferring the mortar and pestle for grinding and who added to their diet through more hunting and fishing, though collecting continued to be extremely important. The final phase shows a marked elaboration of culture and probably a rise in population. Fishing and sea-mammal hunting assumed more significance.

The picture is one of slow progress with simple cultures persisting for long periods. Part of this can be explained by the marginal, isolated position of the Southern California coast in relation to the main centers of cultural development in native North America. Also the habitat did not make numerous and rigorous demands on the people settling in it, so that cultural adaptation to the geographical environment was fairly easy. Once established, the pattern of life was maintained relatively unaltered for many centuries.

There are many critical problems which remain to be solved before a detailed and connected history of human occupation in Southern California can be written. The development of detailed local sequences constitutes a basic need. The rareness of stratified deposits, combined with the general simplicity of form and manufacture of the artifacts and the absence of sensitive time-makers, makes accomplishment of this task difficult. Once reliable local chronologies are set up, the problem of synchronizing regional sequences can be attacked with more assurances of success. Another critical question involves the relationship of the coastal assemblages to those of the interior desert province. For the present only tenuous relationships can be noted. Finally, the Southern California sequence needs to be fitted into a wider western North American or continental perspective.

A contribution toward an answering of many critical questions can be made by an ordering, publication, and interpretation of data already secured. But further field investigations and site reports are badly needed. Also some absolute datings are necessary. There is an ever-growing interest in Southern Californian prehistory and a considerable amount of archaeological research is being carried on, so in the near future, at least, some of the gaps in present knowledge will be filled.

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NOTES ON THE DISPERSAL OF THE DROMEDARY

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CAMEL BREEDING is an obscure topic in culture history. The available evidence from bones, rock drawings, inscriptions, figurines, and historical accounts does not tell where, when, or why camels were domesticated. Gaps in information allow wide variation in interpretations of dispersal. Agreement is lacking even on what needs to be known. No apology needs to be made, therefore, for research and reflection on the early history of the domestic camels. In this paper I have brought together facts and ideas on the dispersal of the dromedary or one-humped camel. Adequate consideration of the Bactrian or two-humped form presupposes familiarity with Russian and Chinese texts which are closed to me.[1]

NATURAL HISTORY

The family of *Camelidae* includes the true camels of Africa and Eurasia and the genus *Lama* (llama, alpaca, guanaco, vicuña) of South America. Naturalists divide the Old World camelids into two species, *Camelus dromedarius*, the slender and tall one-humped form, and *Camelus bactrianus*, the heavier and shorter two-humped form. As defined by the Greeks a *dromas* ("running") camel was any breed used for riding. In this sense both species could be "dromedary," although two-humped riding camels were less common than one-humped varieties. "Dromedary" has come to mean any one-humped camel. The term is used here in this sense, in preference to the question-provoking expression "Arabian camel." It is unfortunate that we do not have an alternative term for the two-humped variety, for the original home of the Bactrian is not yet known with certainty.[2]

The ancestry of the camels has been traced to *Protyplus*, an animal about the size of a jack rabbit known from the Eocene of North America. The disappearance of the camel from its ancestral home is part of the general mystery of the extermination of North American Pleistocene mammals. Prior to and during the Ice Age camels migrated to Asia. Fossil camels are known from the Pliocene and

1 For an excellent review of Chinese literature on the two-humped camel see Edward H. Schafer, *The Camel in China Down to the Mongol Dynasty* (Sinologica, vol. 2, pp. 165-194, 263-290, 1950).

2 See Reinhard Walz, *Neue Untersuchungen zum Domestikationsproblem der altweltlichen Cameliden: Beiträge zur ältesten Geschichte des zweihöckrigen Kamels* (Zeitschrift der Deutschen Morgenländischen Gesellschaft, band 104, n.s. band 29, pp. 45-87, 1954).

Pleistocene of China, Siberia, and Russia,[3] and from the Pleistocene of Rumania,[4] Palestine,[5] and North Africa.[6] The likely ancestor of the domestic camels is *Camelus sivalensis*, a fossil form of Pliocene or early Pleistocene age found in the Siwalik Hills of northern India.[7] According to Duerst,[8]

The fossil camels from Eastern Europe and Central Asia seem to be part of the Bactrian line. The main evidence of fossil dromedaries has been found in Algeria. The North African finds were first thought to represent an extinct species *(Camelus thomasii)*, but recent authors label them as "dromedary."[9] At Palikao and Ternifine, about sixty miles south of Oran, camel bones were found with those of extinct species of elephant, hippopotamus, rhinoceros, and buffalo, and with the remains of a Chellean industry.[10] At Sinté and Anglade quarries, near Algiers, camel bones were found in the upper layers of caves blocked by a consolidated dune related to the Monastirian (third interglacial) strand line.[11] Camel bones also have been found in association with upper Pleistocene fauna and Upper

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3 W. D. M[atthew], "Tylopoda" (*Encyclopaedia Britannica*, 1950 edition), vol. 22, pp. 640-642.

4 A. Nehring, *Fossile Kamele in Rumänien und die Pleistocäne Steppenzeit Mitteleuropas* (Globus, band 79, pp. 264-267, 1901).

5 René Neuville, *Le Paléolithique et le Mésolithique du Desert de Judée* (Archives de l'Institut de Paléontologie Humaine, Mémoire 24, 1951), p. 214; also S. Yeivin, *Archaeological News, Israel* (American Journal of Archaeology, vol. 56, 1952), p. 141.

6 C. Arambourg, *Les mammifères quaternaires de l'Algerie* (Bulletin, Société d'Histoire Naturelle de l'Afrique du Nord, tome 20, pp. 63-84, 1929).

7 Hugh Falconer and P. T. Cautley, *Note on the Fossil Camel of the Sivalik Hills* (Asiatic Researches, vol. 19, pp. 115-134, 1836).

8 J. Ulrich Duerst, "Animal Remains from the Excavation at Anau" (in Raphael Pumpelly, *Explorations in Turkestan*, Carnegie Institution of Washington, Publication no. 78, vol. 2, p. 384, 1908).

. . . it seems to be highly probable . . . that the one-humped and two-humped camels were developed in different countries, and that while all descended from the ancestral form of the Siwalik Hills, one branch, reaching Western Asia and Eastern Europe . . . was two-humped; while the other branch, passing like the Indian buffalo *(Bubalus palaeindicus)* into Africa, formed the one-humped variety of Northern Africa and Arabia.

9 F. R. Wulsin, *The Prehistoric Archaeology of North West Africa* (Papers, Peabody Museum of American Archaeology and Ethnology, vol. 19, 1941), p. 152.

10 A. Pomel, *La Station quaternaire de Palikao* (Matériaux pour l'Histoire Naturelle et Primitive de l'Homme, tome 22, pp. 221-232, 1888); *idem, Sur la Station Préhistorique de Ternifine près Mascara* (Association Française pour l'Avancement des Sciences, 14e Congrès, pp. 504-505, 1885).

11 C. Arambourg, *Note préliminaire sur une nouvelle grotte à ossements des environs d'Alger* (Bulletin, Société d'Histoire Naturelle de l'Afrique du Nord, tome 23, pp. 154-162, 1932); *idem, La grotte de la Carrière Anglade à Guyotville* (Bulletin, Société d'Histoire Naturelle de l'Afrique du Nord, tome 26, pp. 15-22, 1935).

Paleolithic artifacts.[12] The Paleolithic hunters of North Africa probably pursued camels along with other Pleistocene mammals. The presence of camel bones in a few Neolithic sites suggests continued pursuit,[13] although the absence of the animal in early historic time indicates that it had become or was becoming scarce. During the Pleistocene dromedary or pre-dromedary camels ranged from the Atlantic coast of Africa to the Punjab. At the dawn of history they were extinct in the western half of this range. Domestication probably prevented their complete extermination.

"Wild camels," presumably dromedaries, were reported from the Nabataean region of northwestern Arabia by Strabo,[14] but there are no reports of true wild dromedaries in recent time. Wooden slips discovered in Ninghsia tell of the pursuit of wild Bactrians on the northern frontier of China in the first century BC. There are Chinese reports of both wild and tame camels in Mongolia from the tenth and eleventh centuries AD.[15]

In 1877 the Russian explorer Prejevalsky observed a "wild camel" near Lop Nor on the eastern edge of the Tarim Basin.[16] Later, members of the Sven Hedin expedition observed "wild camels" in the Lop Nor region, and Owen Lattimore observed them in the Edsin Gol and Gashun Gobi.[17] They were lighter and more agile than the domestic breeds, and had shorter ears and muzzles. These differences, plus the smaller size of one of the lower molars, led Leche to conclude that the specimens collected by the Hedin expedition were nearer to the fossil camels than to the domestic Bactrian.[18] Other students following Leche have described the "wild" camels as "living survivors of the ancestors of the two-humped camel."[19] The evidence for this interpretation is not convincing. The earliest Chinese texts may have referred to wild forms, but the "wild" camels observed in recent time do not show marked departure from the appearance of the ordinary Bactrian.[20]

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12 Alfred S. Romer, *Pleistocene Mammals of Algeria: Fauna of the Paleolithic Station of Mechta-el-Arbi* (Logan Museum Publications in Anthropology, Bulletin, vol. 1, no. 2, 1928), p. 107.

13 *Loc. cit.*

14 Strabo, *Geography*, Book XVI, Chapter 4.

15 Schafer, *op. cit.*, pp. 176, 187.

16 [Colonel] N. Prejevalsky, *From Kulja Across the Tian Shan to Lob-Nor* (London, 1879), pp. 88-97.

17 Wilhelm Leche, "Zoologie" (in Sven Hedin, *Scientific Results of a Journey in Central Asia, 1899-1902*, vol. 6, part 1, Stockholm, 1904), pp. 49-60; Owen Lattimore, *The Desert Road to Turkestan* (London, 1928), pp. 195-196, 219.

18 *Idem*, p. 60.

19 Schafer, *op. cit.*, p. 167; also Francis Harper, *Extinct and Vanishing Mammals of the Old World* (American Committee for International Wild Life Protection, Special Publication no. 12, 1945), p. 421.

20 Leche, *op. cit.*, figs. 60b-61.

The differences that do appear suggest feral rather than wild characteristics. Moreover, "wild" camels have been tamed and domestic breeds have joined "wild" herds. Since interbreeding occurs at present and presumably has occurred since antiquity, the status of the "wild" camels as "living survivors" is very dubious.

On the basis of vague reports by a few Sudanese officers, Cauvet suggests that a distinct species of one-humped camel may survive on the southern fringe of the Sahara.[21] Bactrian and dromedary breeds both possess 34 teeth, whereas "Sudanese camels" are alleged to have two additional molars, giving a total of 36 teeth. The "Sudanese camels" also are alleged to have poorly-defined humps. Since the premolars of the milk teeth of the dromedary are not replaced by permanent teeth, young animals could be expected to have an abnormal number of teeth.[22] The anomalous hump probably represents a racial difference. Camel breeders have long recognized distinctions of color, size, speed, and durability. Even fighting qualities have been bred. From Mauritania to Iran, camels bred in sandy regions *(erg)* are considered as unfit for travel in rocky regions *(hammada)*. Differences of vegetation and terrain make it advisable for trans-Saharan caravans to employ three breeds: "northern" from the Atlas slopes to Tidikelt or Ra'at, "Hoggar" through the central mountains, and "southern" from Iférouane to Zinder or Kano.[23]

RANGE OF THE DROMEDARY AND BACTRIAN

From the last years of the Roman Empire down to the present time the dromedary has occupied the hot deserts and steppes of North Africa and Asia. In general terms this range can be described as extending from the Atlantic coast of the Sahara through the Fertile Crescent and the plateau of Iran to the Punjab. The northern limits of this range are set by the Mediterranean Sea and the competitive province of the Bactrian. Cultural and environmental barriers mark the southern limits of the dromedary. Disease, slippery footing, and native abhorrence of milk have checked its use in the wetter regions of tropical Africa,[24] whereas environmental barriers alone have kept it out of the Ganges valley and the Deccan. The two-humped camel is at home in the colder deserts and steppes extending from the Caspian Sea eastward through the Takla Makan and the Gobi to the

21 [Commandant] G. Cauvet, *Dromadaires à 34 dents et dromadaires à 36 dents* (Bulletin, Société d'Histoire Naturelle de l'Afrique du Nord, tome 20, pp. 247-256, 1929); I have not had access to Cauvet's two-volume study, *Le Chameau* (Paris, 1925-26).

22 A. S. Leese, *A Treatise on the One-Humped Camel* (Stamford, England, 1927), pp. 29-34.

23 E.-F. Gautier and R. Chudeau, *Mission au Sahara* (Paris, 1909), tome 2, p. 207.

24. P. B. E. Acland, *Notes on the Camel in the Eastern Sudan* (Sudan Notes and Records, vol. 15, pp. 119-149, 1932); R. Rousseau, *Le Chameau au Sénégal* (Bulletin, Institut Français d'Afrique Noire, tome 5, pp. 67-79, 1943); Frederick Simoons, *The Non-Milking Area of Africa* (Anthropos, vol. 49, pp. 58-66, 1954).

border of Manchuria. Man and nature limit the use of the Bactrian in China.[25] On the grassy plateau of Tibet is it replaced by the yak. Northern expansion is checked by the forests and marshes of the Siberian *taiga*.

Neither province has been inviolate. In Han times the dromedary was known to the Chinese as an occasional article of tribute or gift.[26] In 1926 Lattimore encountered a few dromedaries on the eastern edge of the Tarim Basin.[27] On the other hand, Bactrians have entered the dromedary's range. In the nineteenth century two-humped camels were occasionally seen in Syria, Anatolia, Iran, Afghanistan, and northern India. In 1865 G. P. Marsh wrote that they were "still employed in Persia, Bokhara and Tartary, for military purposes, and especially for the conveyance of light pieces of artillery . . . mounted between the humps."[28] The two-humped camel was not unknown to the Arabs, for it is mentioned in an Arabian poem:[29]

> Joints of the Bactrian did his table boast,
> Choice fair and drinks betrayed the generous host.

These, however, are exceptional occurrences. The respective provinces of the two species emphasize the Bactrian's greater tolerance of continental climate and mountainous terrain. The dromedary meets a severe test on the wind-swept plains of Turkestan and in the mountains of Anatolia, Iran, and Afghanistan. Hybrids in these areas may represent attempts to overcome the dromedary's disadvantages.[30] In Anatolia and Khorasan male Bactrians are imported for breeding with local dromedaries. The offspring is described by Leese as a one-humped animal with the best qualities of each parent. Like the dromedary, it is agile and fast; like the Bactrian, it can be worked in rough terrain and in snow.[31] In Asia Minor breeding of Bactrian-dromedary crosses seems to have been a specialty of Turcoman tribes.[32] The same people would have been likely initiators of mule breeding. Since the camel hybrids are sterile, separate domestication of the two species must be inferred.

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25 See J. E. Spencer, *Asia East by South: a Cultural Geography* (New York and London, 1954), pp. 90-94, fig. 26.

26 Schafer, *op. cit.*, pp. 285-286.

27 *Op. cit.*, pp. 151-152.

28 George P. Marsh, *The Camel: His Organization, Habits and Uses, Considered with Reference to His Introduction into the United States* (Boston, New York and Cincinnati, 1856), p. 185.

29 *Idem*, p. 172; Diodorus' report of two-humped camels in southern Arabia may not have been correct (*Diodorus the Sicilian*, Historical Library, Book II, Chapter 54).

30 Al Masudi's reference to hybrid camels, dating from the middle of the tenth century, is the earliest I have found (*Les Prairies d'Or*, Paris, 1864, vol. 3, p. 4).

31 *Op. cit.*, p. 133.

32 *Loc. cit.*

EVIDENCE OF DISPERSAL

Egypt

Egypt has been the focus of discussion on the early history of the dromedary, mainly because of the application of this problem to questions of Biblical authenticity.[33] The statements in Genesis 12:16 that the wife of Abraham had "asses and camels" and in Exodus 9:3 that camels were stricken in Egypt during the plague are variously interpreted as "historical facts" and as "shocking anachronisms." Students of the problem have formed three camps. The common interpretation is that camels were rare or even unknown prior to the Persian invasion of Egypt in the sixth century BC.[34] Others believe that camels were known from prehistoric times.[35] Still others hold that camels, presumably wild, lived on the frontiers of Egypt in prehistoric times but disappeared between the Third and Sixth Dynasties and did not reappear until domestic breeds were introduced from the east around 500 BC.[36]

Evidence of Egyptian knowledge of the camel prior to the Persian conquest is not abundant, but it does exist. An inscription of the Assyrian king Esarhaddon indicates that he used Arabian camels in his campaign against Egypt in the seventh century BC.[37] A pottery figurine of a camel laden with water jars was found at Abydos in a tomb dating from about 1000 BC.[38] Another figurine has been assigned to the New Kingdom (1500-1000 BC),[39] and a camel skull was found in the Faiyum with fragments of pottery dated between the Twelfth and Eighteenth Dynasties (2000-1300 BC).[40] A figurine tentatively identified as a camel representation was found at the Egyptian colony of Byblos with objects dating from the first half of the second millennium BC.[41] Other models have been related to objects from the Old Kingdom or about 2500 BC.[42] Schweinfurth discovered a pecked drawing of a dromedary being led by a man next to a Sixth Dynasty

33 For an excellent review of the problem see J. P. Free, *Abraham's Camels* (Journal of Near Eastern Studies, vol. 3, pp. 187-193, 1944).

34 Carleton S. Coon, *The Story of Man* (New York, 1954), p. 270.

35 Free, *op. cit.*, p. 193.

36 A. E. Robinson, *The Camel in Antiquity* (Sudan Notes and Records, vol. 19, p. 64, 1936).

37 James Henry Breasted, *A History of Egypt, From the Earliest Times to the Persian Conquest* (New York, 1916), p. 555.

38 F. W. Von Bissing, *Zur Geschichte des Kamels* (Zeitschrift für Ägyptische Sprache), band 38, pp. 68-69, 1900).

39 M. F. Bisson de la Roque, *Rapport sur les fouilles de Médamoud* (Fouilles de l'Institut Français d'Archéologie Orientale du Caire, tome 7, 1929), pp. 37, 56.

40 O. H. Little, *Recent Geological Work in the Faiyum and in the Adjoining Portion of the Nile Valley* (Bulletin, Institut d'Égypte, tome 18, 1935-36), pp. 209, 215.

41 Pierre Montet, *Byblos et l'Égypte* (Paris, 1928), p. 91.

42 Albert T. E. Olmstead, *History of Palestine and Syria to the Macedonian Conquest* (London and New York, 1931), p. 70.

inscription at Aswan; since the inscription and the drawing were in the same technique, he concluded that domestic dromedaries must have been known in Egypt prior to 2250 BC.[43] Miss Caton-Thompson found a camel-hair cord in the gypsum quarries of the Faiyum scarp; the occurrence of the cord with pottery of the Third or early Fourth Dynasties left "no possibility of error in its Old Kingdom authenticity."[44] Möller discovered a small vessel at Abusir el-Meleq "in the form of a recumbent [pack] camel" which he equated with objects of the First Dynasty (*circa* 3000 BC).[45] Figurines found at Hierakonpolis and Abydos also have been related to objects of the First Dynasty, and there are a few claims for the occurrence of camel representations of Protodynastic date.[46]

The critical items are those which suggest domestication. The camel-hair cord and the figurines of pack-camels *could* be importations.[47] It is to be regretted that the simple sketch which accompanies Schweinfurth's article is the only published record of his discovery. The fact that a pecked drawing of a dromedary was discovered with a pecked inscription of the Sixth Dynasty cannot be taken as proof of contemporaneous execution, for rock engravings usually show some variety of pecking or scratching techniques.

There is good reason for cautious appraisal of this evidence. Animal themes are common, perhaps dominant, in Egyptian art. One could easily collect evidence from inscriptions, figurines, and wall reliefs to suggest that antelopes, leopards, and hyenas were known as domestic animals. While it cannot be denied that camels, or at least representations of them, are known from a very early time, the available evidence does not suggest common knowledge of the animal until Persian or even Graeco-Roman times. In his report on the rock drawings of the Nubian Nile, Winkler places camel outlines with Graeco-Roman or Arabic inscriptions.[48] The elaborate explanations of Cauvet and others that the camel was a "dieu du mal" and hence taboo as an art motif are scarcely credible.[49] It is difficult to believe that

43 Georg Schweinfurth, *Ueber alte Tierbilder und Felsinschriften bei Assuan* (Zeitschrift für Ethnologie, band 44, 1912), p. 633.

44 G. Caton-Thompson, *The Camel in Dynastic Egypt* (Man, vol. 34, 1934), p. 31.

45 Georg Möller, *Ausgrabungen der Deutschen Orient-Gesellschaft auf dem vorgeschichtlichen Friedhofe bei Abusir el-Meleq* (Mitteilungen der Deutschen Orient-Gesellschaft zu Berlin, no. 30, 1906), pp. 16-17. This identification is doubtless due to the shape of the neck and the high back; the head is more difficult to identify.

46 Free, *op. cit.*, p. 190.

47 See the discussion of Möller's discovery in S. R. K. Glanville, *Egyptian Theriomorphic Vessels in the British Museum* (Journal of Egyptian Archaeology, vol. 12, 1926), p. 58.

48 Hans A. Winkler, *Rock-Drawings of Southern Upper Egypt* (Archaeological Survey of Egypt, I: 1936-37, II: 1937-38).

49 [Commandant] G. Cauvet, *Le dromadaire de l'Oued Itel* (Bulletin, Société d'Histoire Naturelle de l'Afrique du Nord, tome 28, 1937), p. 524; also W. M. M[üller], "The Camel" (in T. K. Cheyne, ed., *Encyclopaedia Biblica*, vol. 1, New York and London, 1899), p. 634; and Vincent Monteil, *Essai sur le Chameau au Sahara Occidental* (Études Mauritaniennes, no. 2, 1952), p. 129.

camels would have been singled out for a special taboo while all of the known domestic animals (not to mention frogs, baboons, beetles, and crocodiles) were venerated. Even if we grant the possibility of such a taboo, it is hardly likely that it would have persisted long enough to almost totally obscure the presence of the animal.

North Africa

From Egypt the dromedary spread westward into North Africa. At the turn of the century Stéphane Gsell presented a careful review of the historical evidence of this dispersal,[50] and later scholars have accepted his general conclusions.[51] Gsell's position is easily summarized. The Paleolithic and Neolithic remains represent a wild species which became extinct. The domestic dromedary was a late introduction. It does not figure in the earliest rock drawings and there is no historical evidence of the animal earlier than the time of Roman rule. In Herodotus' list of the wild and domestic animals of Libya there is no mention of camels.[52] Pliny described two kinds of camels "those of Bactria and those of Arabia," but he made no mention of camels in Africa.[53] Nor is there mention of camels in the Carthaginian records. The absence of any indication of camels in the accounts of the Punic Wars establishes that the Romans neither used the animal nor encountered it among native peoples. The first reference dates from 46 BC, when Julius Caesar captured twenty-two camels from the army of Juba.[54] The first indication of a large number of camels dates from 363 AD, when General Romanus demanded 4000 from the citizens of Leptis Magna for use in the transport of his army.[55]

Following Gsell, students of North African rock art usually label drawings with camel figures as "Roman or later."[56] Since camels date the drawings and not the converse, the enormous literature on rock art throws little light on the dispersal of the dromedary. As a rule "prehistoric" drawings are large and show extinct fauna or human figures with prehistoric equipment, whereas "camel age" drawings are small and show a modern fauna or historically recognizable human figures. Moreover, the "camel age" drawings are usually less patinated and they are often

50 Stéphane Gsell, *Histoire Ancienne de l'Afrique du Nord* (2nd ed., Paris, 1914), tome 1, pp. 59-62, 111-158. Gsell's study seems to have been the main reference for scholars writing in the French language. Carl Ritter considered the same problem and reached similar conclusions some fifty years earlier; see his essay on the distribution of the camels in Die Erdkunde, teil 13, band 8, Berlin, 1847, pp. 609-759.

51 E.-F. Gautier, *Le Passé de l'Afrique du Nord* (Paris, 1937), pp. 188-210.

52 Herodotus, *History*, Book IV, Chapters 191, 192.

53 Pliny the Elder, *Natural History*, Book VIII, Chapter 26.

54 Gsell, *op. cit.*, p. 60.

55 *Loc. cit.*

56 Henri Lhote, *Le Cheval et le Chameau dans les peintures et gravures rupestres du Sahara* (Bulletin, Institut Français d'Afrique Noire, tome 15, pp. 1212-1225, 1953).

accompanied by Libyco-Berber or Arabic inscriptions.[57] Nevertheless, there is no assurance that all of the drawings with camel figures date from Roman or post-Roman time. There are reports from the Libyan desert and from the Tassili region of camel outlines markedly different from the "camel age" drawings.[58] Capot-Rey has wisely cautioned against the imprudence of concluding, from the mere presence of a camel figure, that a drawing is of very recent date.[59]

Between the time of the Persian invasion of Egypt (which it will be remembered is a conservative date for the introduction of the camel) and the first years of Roman rule in North Africa is a gap of half a millennium. During this interval the dromedary may have penetrated the Sahara. As there is evidence of friendly relations between Ptolemy II and the Meroitic rulers it is reasonable to assume that the animal was used for transport in the Nubian desert in the third century BC.[60] At this time it may also have been used for transport between the Nile valley and the oases of Siwa, Kharga, and Dakhla. Evidence is accumulating of an elaborate system of horse-chariot routes in the Sahara.[61] Dromedaries could easily have moved along the same routes. The camel may well have been introduced to Tunisia and Cyrenaica in Roman time, but the questions of when and how it reached the central and southern portions of the Sahara have yet to be answered. It is difficult to believe that the "ship of the desert" would have been confined to the Nile valley for several hundred years.

Northern India

Since Egypt and North Africa seem to be marginal in the dispersal of the dromedary, attention must turn to the east. The meager evidence of the animal in prehistoric India suggests that this region, too, is marginal. Dromedary bones have been found in the latest layers at Mohenjo-Daro and Harappa, but the animal is never represented by clay models and does not appear on seals.[62] Prashad's assumption that the dromedary bones of Mohenjo Daro and Harappa show direct descent from the fossil camel of the Siwalik Hills is less than credible.[63]

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57 For an extended discussion of the age of North African rock drawings see Raymond Vaufrey, *L'Art rupestre Nord-Africain* (Archives de l'Institut de Paléontologie Humaine, Mémoire 20, 1939).

58 M. H. Breuil, *Les gravures rupestres du Djebel Ouenat* (Revue Scientifique, 66e Année, 1928), p. 106, figs. 50, 56; Robert Perret, *Recherches archéologiques et ethnographiques au Tassili des Ajjers* (Journal, Société des Africanistes, tome 6, 1936), p. 49.

59 Robert Capot-Rey, *Le Sahara Français* (Paris, 1953), p. 85.

60 Robinson, *op. cit.*, p. 63.

61 E.-F. Gautier, *Anciennes voies du commerce transsaharien* (Geografiska Annaler, [supplement to] vol. 17, pp. 550-651, 1935); Raymond Mauny, *Une route préhistorique à travers le Sahara occidental* (Bulletin, Institut Français d'Afrique Noire, tome 9, pp. 341-357, 1947).

62 V. Gordon Childe, *New Light on the Most Ancient East* (London, 1952), p. 176.

63 B. Prashad, *The Animal Remains from Harappa* (Memoirs, Archaeological Survey of India, no. 51, 1936), pp. 9, 58-59.

A few bones on top of the sites of the Harappa civilization do not provide much support for such an assertion. It is not unlikely that the dromedary was introduced to India by the Aryan conquerors of the Indus state.

Iran

The role of Iran in the dispersal of the dromedary is difficult to evaluate. Piggott refers to a camel representation on bronze from a site probably of the second millennium BC in Persian Makran, but he does not indicate which species is depicted.[64] The sculptured reliefs on the Royal Palaces at Persepolis show Bactrians.[65] Allusions to camels, as sacrificial animals and as tokens of wealth, are frequent in the *Avesta*. In the twenty-second chapter of the *Vendidad*, for example, one reads that Ahura-Mazda promised an offering of "a thousand camels, swift, with strong humps." The *Avesta* also includes a number of names ending in *uštra* (possessing camels), most notably *Zarathuštra*.[66] Unfortunately, it cannot always be established whether Bactrians or dromedaries are involved. Most of Iran is within the present range of the dromedary, but the art of the Sassanian[67] and Islamic[68] periods shows some Bactrians.

It might be inferred that Bactrians were ancient imports from Turkestan and that dromedaries were introduced from the west during the Sassanian period. The proximity of Iran to classical Bactria favors the hypothesis that two-humped camels were known first. It must be noted, however, that the evidence for Bactria as the home of the two-humped camel is entirely circumstantial. Bactria comes to mind because of Greek dissemination of the expression "Bactrian camel." The facts that two-humped camels were known in the Occident as "Bactrian" and that two-humped camels figure on Bactrian coins do not establish this region as the place of domestication. When the Greeks arrived in Bactria two-humped camels were known from Bessarabia to the Gulf of Pohai. The common Chinese terms for the two-humped camel, *t'o-t'o* and *lo-t'o*, have no known connection with Bactria.[69] The Sogdians, who were great caravaneers and neighbors of the "Bactrians," referred to camels as *'wstr-*, a term related to the Old Persian word

64 Stuart Piggott, *Prehistoric India to 1000 B.C.* (Harmondsworth, England, 1950), p. 157.

65 Arthur Upham Pope, ed., *A Survey of Persian Art from Prehistoric Times to the Present* (London and New York, 1938), vol. 4, pp. 91, 93.

66 Louis H. Grey, "[The Camel] Among the Iranians" (*Encyclopaedia of Religion and Ethics*, New York, 1919), vol. 3, pp. 174-175.

67 J. de Morgan, *Mission Scientifique en Perse* (Paris, 1877), tome 4, plate 37, facing p. 320. I base this identification upon the general appearance of the animals, rather than on the humps, which are obscured by packs.

68 A. F. K[endrick], "Textiles and Embroideries" (*Encyclopaedia Britannica*, 1950 edition), vol. 22, plate II, fig. 1.

69 Schafer, *op. cit.*, pp. 169-173.

uštra.[70] The nearest archaeological records of the animal come from Anau, where Bactrian bones were found in the latest layers of a "copper period" horizon,[71] and Shah Tepé, where Bactrian bones have been dated tentatively from 3000-2500 BC.[72]

Mesopotamia

Because of its situation athwart major communication lines, Mesopotamia might be expected to add significantly to the history of the camels. The Mesopotamian record is disappointing in that it does not establish the camel as an important domestic animal until the Assyrian era (circa 1000 BC).[73] However, the Mesopotamian record does show early knowledge of both the Bactrian and the dromedary. The earliest historical record of the Bactrian is an inscription which mentions two-humped camels during the reign of Tiglath-Pileser I (1115-1074 BC).[74] The black obelisk of Shalmaneser III (860-825 BC) also shows Bactrians, represented as tribute from Gilzani, a kingdom in eastern Anatolia.[75] The bronze gates of Shalmaneser III carry the earliest historical record of the dromedary in Mesopotamia,[76] but statuettes of dromedaries found at Warka have been placed as early as the Kassite Period (1600-1150 BC),[77] and a mutilated figurine from the Anu Ziggurat has been assigned to the Ubaid period (*circa* 3000 BC).[78]

With early dates assigned to a few figurines and historical evidence generally dating from the first millennium BC, the camel is as much an enigma in Mesopotamia as in Egypt. The Old Semitic word for the camel was *gammalu*, but in writing it the Summerian cuneiform sign for the sea was used, designating the animal as "Beast of the Sea (land)."[79] This designation suggests that the animal was introduced from the Persian Gulf coast of Arabia.[80] It is of interest to note that Assyrian wall reliefs show camels being used as pack animals, but only captives or other foreigners are shown riding them.[81]

70 *Idem*, p. 172.

71 Duerst, *op. cit.*, p. 383.

72 J. Wolfgang Amschler, "Tierreste der Ausgrabungen von dem 'Grossen Königshügel' Shah tepé in Nord-Iran" (in Sven Hedin, *The Sino-Swedish Expedition*, Publication 9, VII, Archaeology 4, Stockholm, 1939), pp. 77-80.

73 Percy S. P. Handcock, *Mesopotamian Archaeology* (New York, 1912) p. 390.

74 Bruno Meissner, *Babylonien und Assyrien* (Heidelberg, 1920), band 1, p. 220.

75 L. W. King, *Bronze Reliefs from the Gates of Shalmaneser III* (London, 1915), Plate XL.

76 *Idem*, plates XXIII and XXIV.

77 Max Hilzheimer, *Einige Rätsel aus der Geschichte der Haustiere* (Zeitschrift für Ethnologie, band 64, 1932), p. 139.

78 E. Douglas Van Buren, *The Fauna of Ancient Mesopotamia as Represented in Art* (Analecta Orientalia, vol. 18, 1939), p. 36.

79 Raymond Philip Dougherty, *The Sealand of Ancient Arabia* (Yale Oriental Series, Researches, vol. 19, 1932), p. 155.

80 The evidence for the identification of "Sealand" with the east coast of Arabia is given in Dougherty, *op. cit.*, pp. 148-174.

81 Van Buren, *op. cit.*, p. 36.

Palestine

I have already referred to Palestine as one of the areas where Pleistocene camel bones have been found. Stekelis recently discovered camel bones in a Neolithic horizon on the banks of the Yarmuk River.[82] He assumes that a wild species was hunted for food. From the Neolithic to Classical time there are only a few camel remains from sites of middle Bronze Age. These include teeth from Gezer and Megiddo, a skull from Taannek, and bones from El Jisr.[83] The poverty of the record of the camel in Palestine is traceable in part to the law in Leviticus 11:4, which calls the animal unclean "because he cheweth the cud, but divideth not the hoof."

ARABIA, THE PROBABLE HEARTH OF DOMESTICATION

The common acceptance of Arabia as the home of the dromedary is based not on evidence of early occurrence but on Arabia's classical reputation as a place of dromedary breeding. Strabo wrote of nomads on the west coast "who live by their camels . . . fight from their backs . . . travel upon them, and subsist on their milk and flesh."[84] Diodorus referred to camels as the most important domestic animals in southern Arabia.[85] Pliny noted the importance of dromedaries in the transport of frankincense,[86] and in a discourse on the two species he referred to one-humped camels as "those of Arabia."[87] Herodotus described the legions of Xerxes' army "all marshalled in squadrons, excepting the Arabians; who are placed last, to avoid frightening the horses, which cannot endure the sight of the camel."[88]

The classical record is clear enough, but it is far too late to establish Arabia as the place of domestication. Lacking archaeological or paleontological evidence, one can only assume that parts of Arabia would have been favorable retreats for the wild dromedary and that Arabia's classical reputation reflected a long tradition of dromedary breeding. The animal was certainly used in the spice, salt, and incense trade of the Minaean Kingdom of southern Arabia (*circa* 1000 BC), but it is far from certain that the dromedary was domesticated at this time for this purpose. Domestication probably was effected in earlier, "preliterate," times by people with prior knowledge of the ass. A substitute domestication of the dromedary may be inferred to have taken place as agricultural peoples moved to the edge of arid land. This inference is based upon two premises: (1) that wild camels

82 M. Stekelis, *A New Neolithic Industry: the Yarmukian of Palestine* (Israel Exploration Journal, vol. 1, 1950-51), pp. 5, 17.

83 B. S. J. Isserlin, *On Some Possible Early Occurrences of the Camel in Palestine* (Israel Exploration Fund Quarterly, vol. 82, pp. 50-53, 1950).

84 Strabo, *Geography*, Book XVI, Chapter 4.

85 Diodorus the Sicilian, *Historical Library*, Book III, Chapter 44.

86 Pliny the Elder, *Natural History*, Book XII, Chapter 32.

87 *Idem*, Book VIII, Chapter 26.

88 Herodotus, *History*, Book VII, Chapter 87.

could only have survived in the more arid areas where refuge from predatory beasts and man was available, and (2) that the initial taming and selective breeding could only have been undertaken by sedentary peoples.

The first premise does not require elaboration; the second, and the conception of motives for domestication that is behind it, must be examined at length. The motives of the domesticators may have had little to do with present uses of the animal. Camel sacrifices were common in pre-Islamic Arabia.[89] Ibn al-Baytar's treatise on the medicinal and magical properties of camel meat, milk, and urine suggest a long tradition of interest in the animal unrelated to food.[90] In the highlands behind Dhofar, pre-Arabic speaking peoples survive, with a cattle culture comparable to that found in parts of East Africa.[91] Among such people, domestication might have involved transfer to a new beast of attitudes associated with a cattle cult. For all we can certainly know, dromedaries were domesticated because their movements were amusing or because they were "ugly" or "beautiful."

Fortunately, the problem of utilitarian versus non-utilitarian motives in domestication does not prejudice consideration of the probable sequence of economic uses. Wild dromedaries could not have been put to immediate use by hunters, pastoralists, or caravaneers. A long process of selective breeding must be inferred, and only settled people would have had the leisure to undertake the task. The hypothesis that shepherds or hunters made excursions into the desert to capture wild camels for mounts or as a source of "tame game" is attractive but unbelievable. Shifting groups are especially ill equipped to prepare enclosures. The generations of effort required to produce a domestic animal presuppose long-range interests which pastoralists or hunters are unlikely to have possessed. The notion that dromedaries were domesticated by caravaneers implies the satisfaction of an immediate end. Taking a clue from the shyness and elusiveness of the feral Bactrians, I doubt that wild dromedaries could have been loaded and held in line. The present character of the dromedary as a tractable caravan animal appears to be a result of long breeding. The domestic dromedary is virtually a dependent of man, its ability to survive in a wild state having been bred out. The temperament of the first pack and riding dromedaries may have been just as far removed from that of the ancestral wild stock.

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89 M. Gaudefroy-Demombynes, "The Camel" [in Arabia] (*Encyclopaedia of Religion and Ethics*, New York, 1919), vol. 3, p. 173.

90 Ibn el-Baithar, *Traité des Simples* (Notices et Extraites des Manuscrits de la Bibliothèque Nationale et Autres Bibliothèques, tome 23:1, 1877), pp. 292, 368-70; also David Hooper and Henry Field, *Useful Plants and Drugs of Iran and Iraq* (Botanical Series, Field Museum of Natural History, vol. 9, 1937), p. 197.

91 Carleton S. Coon, *Southern Arabia: a Problem for the Future* (Papers, Peabody Museum of American Archaeology and Ethnology, vol. 20, 1943), p. 189.

If this line of reasoning is sound, the origin of domestication of the dromedary is to be sought where sedentary peoples were living on the edge of arid land. Early agriculture is known in northwest and southwest Arabia and along the Persian Gulf. Bedouin tradition favors the northwest. The Rwala believe that their camels were taken from Jews during a raid in the Hejaz.[92] Ruins along the southern flank of the Hesma plateau suggest that agriculture in the northwest may be much earlier than the Nabataean settlement of classical time.[93] I have already mentioned Strabo's report of "wild camels" in this region. For what it may be worth, Mrs Horsfield's synchronous dating of a rock drawing of a dromedary and a "Mesolithic ibex" in Kilwa, Transjordan, is additional support.[94] However, placement of the hearth of dromedary breeding in northwestern Arabia has a serious disadvantage: it conflicts with the meager evidence of the animal in Egypt and Mesopotamia. Northwestern Arabia was within range of Egyptian and Mesopotamian ass caravans. A few bones and figurines do not suggest common knowledge of the animal in these regions. Historically, the animal appears suddenly and in large numbers. The obscure record of the dromedary in the Near East cannot be reconciled with the exposed situation of northwestern Arabia.

The same objection applies to the east coast. The coastal lowlands of Hasa and Qatar satisfy the requirement of arable land near "wild camel country," but these areas are culturally and environmentally related to the Kuwait plain and Mesopotamia. The Semitic designation "Beast of the Sealand" suggests that the dromedary was introduced to Mesopotamia from this region, but it does not establish that eastern Arabia was the place of domestication. Domestication here would be the same as domestication in Mesopotamia, a region where archaeological and historical records of the dromedary are fragmentary.

The prerequisites I have suggested are best satisfied in southern Arabia. The deep, north-south trending wadis of Yemen, Hadramaut, and Jol bring shade and water-retaining clay soils to the edge of the Rub' al Khali. Here sedentary populations would have been in contact with "wild camel country." Southern Arabia is far enough from the major trade routes to explain the meagerness of Egyptian and Mesopotamian records of the animal. It is also a region where early use of the dromedary for draft is likely and where prior use of the ass can be inferred.

The motives for the capture, taming, and breeding of the dromedary may have been non-utilitarian, but in due course the animal would have been put to work

92 Alois Musil, *The Manners and Customs of the Rwala Bedouins* (New York, 1928), p. 271.

93 H. St J. B. Philby, *The Lost Ruins of Quraiya* (Geographical Journal, vol. 117, pp. 448-458, 1951).

94 Agnes Horsfield, *Journey to Kilwa, Transjordan* (Geographical Journal, vol. 102, pp. 71-77, 1943).

raising water, threshing, and possibly plowing. Milking may have begun at this time or have been an earlier ceremonial practice. In any case, milking does not seem to have been a major interest. Nor is there evidence in modern breeds of selection for high milk yield. Modern dromedaries produce little more than the milk necessary for their offspring. Bedouin employ all manner of deceptions to get milk: two cows are deceived into accepting one calf as their own; cows are milked from one side while calves are held at the other side, and so forth.

As South Arabian trade in spices, salt, and incense spread northward *domestic* dromedaries would have been used as beasts of burden. Appreciation of the dromedary's utility as a pack animal may have developed from local experiments or it may have developed from observation of caravans of Bactrian camels in Syria or Mesopotamia. The Egyptian and Mesopotamian representations of the dromedary from the second millenium BC probably reflect occasional contacts with the South Arabian merchants of this period.

The rest of the story is reasonably clear. Sheep and goat herders took up a few dromedaries from sedentary peoples, and as their herds grew they moved into less hospitable land. Raid replaced trade and Bedouin life began. The military value of the dromedary did not become generally known until equestrian armies from Assyria and Persia entered Bedouin territory. Military conquest carried Arabian camels eastward to India and westward to Egypt and North Africa. The political stability resulting from these conquests encouraged overland trade.[95] The "ship of the desert" then assumed its final role, and, in time, reached the limits of its modern range.

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95 For an interesting elaboration of this thesis see W. L. Westermann, *Inland Transportation and Communication in Antiquity* (Political Science Quarterly, vol. 43, pp. 364-387, 1928).

AMERICAN ARCHAEOLOGY AND GENERAL ANTHROPOLOGICAL THEORY[1]

PHILIP PHILLIPS

> Yet that all explanations, from whichever point they start, should converge, that they should be compatible and build up the "scheme of reality at large"—this is the ideal (and postulate) of scientific understanding.
>
> Nadel[2]

THIS PAPER owes its existence to a cultural anthropological colleague's invidious remark that archaeology is a technique of investigation merely. He meant, I believe, that archaeology, while providing data and generalizations in such fields as history and general anthropology, lacks a systematic body of concepts and premises constituting *archaeological* theory. Unpalatable as this may seem at first glance to the archaeologist, I do not see how it can be denied. According to this view, the archaeologist must borrow his theoretical underpinning from the field of study his work happens to serve, or do without. Whether the latter alternative is an admissible one does not seem to me to be an arguable point. Acceptable fieldwork can perhaps be done in a theoretical vacuum, but integration and interpretation of archaeological data without theory is inconceivable.

The above remarks apply, I suppose, to archaeology in general, but the sole concern of this paper is American archaeology. It seems to me that American archaeology stands in a particularly close, and, so far as theory is concerned, dependent relationship to general anthropology. Its service to history in the narrower sense, i.e. as the record of events in the past with the interest centered in those events, is extremely limited because for pre-Columbian America there is in effect no such history. The use of traditions derived by Europeans from native informants and of documentary sources of the contact period as starting-points for pushing back into the unrecorded past—the "direct historical approach"—is not archaeology serving history, but the reverse. Again, the role of New World archaeology in providing material for the study of aesthetics is not inconsiderable, but is tangential to the main interest and non-significant from the point of view of theory. In short, paraphrasing Maitland's famous dictum: New World archae-

1 The author gratefully acknowledges his obligation to Clyde Kluckhohn (who was not the colleague mentioned in the first paragraph) for several helpful suggestions, but owes it to him to state that some of them were not followed.

2 This paper is indebted to Nadel for a great deal more than the above quotation, as anyone familiar with his *Foundations of Social Anthropology* will readily see.

ology is anthropology or it is nothing. The American archaeologist, therefore, unless he thinks he can dispense with theory altogether, is obliged to take a stand on some of the basic questions of general anthropological theory.

This paper is an attempt on the part of one New World archaeologist, unschooled in anthropological theory, to see just far enough into it to find out where he stands—but no farther. It is predicated on the belief that anthropology is more science than history, and that its subject matter is *both* society and culture. The first part of this statement appears to settle out of hand the position of anthropology in respect to the dichotomy science-history, a question that has vexed philosophers ever since the emergence of anthropology as a field of study. It seems to the writer that the force of this dichotomy is now largely spent. It was understandable in the days when science dealt in recurrent certainties rather than (as now) in probabilities, and when the possibilities of a "science" of history were not seriously entertained. Now, I think most theorists will agree that the world of anthropology is a mixture of recurrent and unique events, acting and reacting upon each other in a complex fashion, an hybridization of science and history if you will. The only serious disagreement is in respect to the relative size and importance of the two components of the mixture. My own view is that, if the world of anthropological phenomena is governed in part by recurrence, even though it be the smaller part, as seems to be the case, it is decidedly the more important part. And that is just as true for anthropology-based archaeology. Indeed the chief justification for such an archaeology could be said to lie in the fact that it is through knowledge of the other, and larger, part played by the unique event, that the smaller recurrent part can be assessed and understood. Thus, paradoxically, archaeology in the service of anthropology, concerning itself necessarily with the position of unique events in space and time, has for its ultimate purpose the discovery of regularities that are in a sense spaceless and timeless. And since it appears that a comparative method alone will disclose such regularities, it follows that archaeology is faced with the problem of finding, in the seemingly endless flow of cultural and social events, forms and systems of forms that are not only comparable to each other, but also comparable to, or at least compatible with, the forms and systems of forms of cultural and social anthropology.

The second article of belief, referred to above, is that the subject matter of anthropology is both society and culture, another dichotomy that is not standing up under analysis. The interpenetration of social and cultural "facts" (to say nothing of psychological, which are here left out of account for the sake of simplicity only) now seems to be regarded as axiomatic. Following Kroeber and others, I have chosen to refer to them here as *aspects* of the same basic reality. The latter may for present purposes be defined as *patterned behavior*. Archaeology of neces-

sity deals almost exclusively with patterned behavior in its cultural aspect. In New World archaeology especially we have tended to suppress the social aspect altogether. Some of us have been drawn into the extreme position that sees in culture an independent order or "level" of phenomena, intelligible in terms of itself alone, without recourse to any other kind of phenomena—the "cultural superorganic." This is not something one can argue about; you either see it this way or you do not. Most of us, without subscribing to this superorganic view of culture, have nevertheless operated "as if" it were a fact.[3] In my opinion, even this moderate position, though operationally expedient and to a certain extent inevitable, is ultimately detrimental to the main task of archaeology, which is to organize its data insofar as possible in terms of a real world, a world in which cultural and social phenomena (to name only these) are inextricably mingled.

The reader will have noted by this time that this paper is driving toward an accommodation between the seemingly opposed methods and outlook of archaeology and cultural (or social) anthropology.[4] Comparison may be facilitated by considering their respective operations on three levels of organization that are generally applicable to all scientific analysis. These are, in ascending order: *observation, description,* and *explanation.* The accompanying diagram is a crude attempt to show how the operations of archaeology and cultural anthropology can be conceived as converging toward a synthesis from one level to the next.

Explanation	Functional Interpretation	Ethnology
Description	Historical Integration	Ethnography
Observation	Fieldwork	Fieldwork
	Archaeology	*Cultural Anthropology*

On the observational level, archaeological and cultural anthropological fieldwork are placed far apart on the diagram because of the wide differences in the phenomena observed. These differences, however, can be easily over-emphasized. Cultural anthropology observes primarily group behavior in its twofold aspects, social and cultural. It also observes symbolized behavior (language, art, myth,

3 A. L. Kroeber, *The Nature of Culture* (Chicago, 1952), p. 133.

4 "Social anthropology" in England, "cultural anthropology" here. There are not precise equivalents by any means, but are perhaps closer than practitioners in the two countries are ready to admit. This paper follows the American usage, but without any implications of predominant importance of culture over society.

etc.) and materialized behavior (artifacts, technology, etc.) but these differ from the first in that they may be seen in both their social and cultural aspects, or only in the latter. Archaeology observes primarily materialized behavior, but has considerable opportunity to observe symbolized behavior, in the form of art, iconography and (rarely) written language, and occasionally touches group behavior through inferences, as in the interpretation of burial practices, house plans, settlement patterns, roads, irrigation systems and the like. Thus it appears that the raw materials of the two disciplines are not so different after all; what is different is that archaeology is obliged to view its material almost entirely in its cultural aspect. It has sometimes attempted to turn this limitation into an asset by embracing the cultural superorganic as already noted.

The term *historical integration,* as used here, covers almost everything the archaeologist does with his field data: typology, taxonomy, formulation of cultural "units," and investigation of their internal and external relationships in space and time. An alternative expression is "space-time integration." However, highsounding these names, it appears to me that the activities they represent remain essentially on the descriptive level. Explanatory concepts, such as invention, diffusion, stimulus diffusion, etc., are utilized but the aim is primarily description, not explanation. The questions are still put in the form of *what,* not *how.* Historical integration is comparable to ethnography with the time dimension added, but we dare not push the analogy too far because the archaeologist's descriptive formulations, like his observations, lie mainly in the cultural aspect. In a recent paper Gordon Willey and I made a plea in favor of unit concepts (the *phase*) that would at least be intelligible in the social aspect, in respect to scale and internal consistency, but we were at no time under the illusion that *phase* and *society* could be equivalent in a specific sense, except in a known historical context. This is the crux of the whole matter. There is no use pretending that it is not a major difficulty. In the diagram, descriptive integration and ethnography are placed closer together than their respective field observations, but this is more in the nature of a hope than a present reality. It expresses my own belief, however, that archaeological unit concepts can make more sense, in terms of the social aspect, than is usually the case.

So little work has been done in American archaeology on the explanatory level that it is difficult to find a term for it. It might have been left blank on the diagram to emphasize this lack. On the other hand, *functional interpretation* has been used in this context and may be as good as any. It certainly implies an attempt to discover regularities in the relationships given by the methods of descriptive integration. Whatever we call it, the important fact is that on this explanatory level of organization archaeological formulations are viewed in both their cultural and social aspects. It is not possible to go about investigating the *how* of cultural

facts without taking into account their *efficient* causes, which are social facts. Perhaps it is fair to say that the lack of progress in functional interpretation in American archaeology to date is precisely because unit formulations have been put together without much or any reference to their social aspect. In any case, in the same vein of optimism I have placed functional interpretation and ethnology (which latter term seems to me to come closest to representing the operations of cultural anthropology on the explanatory level) side by side on the diagram to suggest a further convergence of aims, if not of practice.

Diagrams and models have the happy faculty of proving whatever theory they are designed to prove, and the present is no exception. However, I suggest that this diagram, with all its crude simplification, represents a pattern that is not wholly fictitious. As archaeology moves from one operational level to the next, it is compelled, I believe, to pay more attention to the social aspect of its data, until there takes place on the explanatory level an actual convergence with cultural anthropology in a common search for socio-cultural causality and law.

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THE BALSA RAFT IN ABORIGINAL NAVIGATION OFF PERU AND ECUADOR

THOR HEYERDAHL

ABORIGINAL NAVIGATION in Peru and adjoining sections of northwestern South America is a subject that has been little known and still less understood by modern boat-builders and anthropologists. The apparent reason is that the local boat-building was based on principles entirely different from those of our own ancestry. To the European mind the only seaworthy vessel is one made buoyant by a watertight, air-filled hull, so big and high that it cannot be filled by the waves. To the ancient Peruvians the size was of less importance; the only seaworthy craft was one which could never be filled by water because its open construction formed no receptacle to retain the invading seas, which washed through. Their object was thus achieved by building exceedingly buoyant, raft-like vessels of balsa or other very light wood, or of bundles of reeds or canes lashed together in boat fashion, or by making pontoons of inflated seal-skins carrying a sort of deck.

Such craft tend to appear primitive, incommodious and unsafe to anyone who is unfamiliar with their qualities at sea, and this may be the reason for the widespread and erroneous assumption that the peoples of ancient Peru were without seagoing craft or capable sailors, in spite of their 2000-mile coastline and their outstanding cultural level in nearly all other respects.

When I first attempted, in 1941,[1] to call attention to the possibilities of early Peruvian navigation, the balsa raft was accorded little attention among the few anthropologists who were familiar with its existence as a pre-European culture element, and many did even overlook the fact that it went under sail in pre-European time. The use of sail was not recorded from other parts of aboriginal America. The general impression appeared to concur with the judgment of Hutchinson[2] in his *Anthropology of Prehistoric Peru* of 1875, where the balsa raft was merely described as "a floating bundle of corkwood." Three modern writers, Lothrop,[3]

1 T. Heyerdahl, *Did Polynesian Culture Originate in America?* (International Science, vol. 1, New York: New World Club, 1941).

2 T. J. Hutchinson, *Anthropology of Prehistoric Peru* (Journal, Royal Anthropological Institute, vol. 4, London, 1875), pp. 426, 454.

3 S. K. Lothrop, *Aboriginal Navigation Off the West Coast of South America* (Journal, Royal Anthropological Institute, vol. 62, pp. 229-256, London, 1932).

Means,[4] and Hornell[5] had presented interesting papers on aboriginal Peruvian craft and navigation, with excellent descriptions of the building principles of the balsa raft, but, on purely theoretical grounds, as we shall see later, they all judged the balsa raft to be water absorbent and useless for navigation in the open sea.

It was on the background of such prejudice that I was stimulated to a further study and reappraisal of Peruvian navigation, since I was led by other observations to suspect that Peruvian balsa rafts had travelled as far as to the islands of Polynesia, 4000 miles away.

The first record of a Peruvian balsa raft antedates the actual discovery of the Inca Empire. When Francisco Pizarro left the Panama Isthmus in 1526 on his second and more progressive voyage of discovery down the Pacific coast of South America, his expedition encountered Peruvian merchant sailors at sea long before he discovered their country. His pilot, Bartolomeo Ruiz, was sailing ahead to explore the coast southwards near the equator, when off northern Ecuador his ship suddenly met another sailing vessel of almost equal size, coming in the opposite direction. The north-bound vessel proved to be a large raft, and its crew were the first Peruvians ever seen by Europeans. Immediately afterwards a report was sent to Charles V by Juan de Sàamanos,[6] and the episode was recorded even before Peru itself had been visited. The event was also narrated in 1534 by Pizarro's own secretary, Francisco de Xeres. From both sources we learn that the large balsa raft was captured by the Spaniards, who found a crew of twenty Indian men and women aboard. Eleven were thrown overboard, four were left with the raft, and two men and three women were retained aboard the caravel to be trained as interpreters for the later voyages.

The balsa raft was a merchant vessel heavily laden with cargo. The Spaniards estimated its capacity at thirty toneles, or about thirty-six tons, as compared with the forty tons of their own caravel, which carried only half as many persons as did the balsa raft. The cargo was carefully listed by the Spaniards, and included some items which could only have come from Peru proper.

The craft was described by Sàamanos as a flat raft, composed of an underbody of logs covered by a deck of slender canes raised so that crew and cargo remained dry while the main logs were awash. The logs as well as the canes were lashed securely together with henequen rope. Sàamanos says of the sail and rigging of the raft:

4 P. A. Means, *Pre-Spanish Navigation Off the Andean Coast* (American Neptune, vol. 2, no. 2, 1942).

5 J. Hornell, *Was There a Pre-Columbian Contact Between the Peoples of Oceania and South America?* (Journal, Polynesian Society, vol. 54, pp. 167-191, 1945).

6 Juan de Sàamanos, *Relación de los Primeros Descubrimientos de Francisco Pizarro y Diego de Almagro: Sacada del códice número CXX de la Biblioteca Imperial de Viena* (Colección de Documentos Inéditos para la Historia de Espana, vol. 5, Madrid, 1844).

It carried masts and yards of very fine wood, and cotton sails in the same shape and manner as on our own ships. It had very good rigging of the said henequen, which is like hemp, and some mooring stones for anchors formed like grindstones.[7]

Ruiz now returned to Pizarro with his prisoners and booty, and a few months later a new expedition, led by Pizarro, pushed southward to the northern coasts of the Inca Empire. On the way to Santa Clara Island in the open Gulf of Guayaquil, Pizarro overhauled five sailing balsas in two days, and opened favorable negotiations with their crews. Then he crossed the Gulf to the Peruvian port of Tumbez, the home of some of his raft captives. When approaching the coast the Spaniards saw a whole flotilla of balsa rafts standing towards them, carrying armed Inca troops. Running alongside the fleet Pizarro invited some of the Inca captains aboard his vessel, and by establishing friendly relations through his interpreters—those captured from the first raft encountered—he learned that the whole flotilla was bound for Puna Island which was then under Peruvian rule.

Other balsa rafts came out of the bay with gifts and provisions for the Spaniards, and we learn from Francisco Pizarro's cousin, Pedro, that a little farther down the Peruvian coast the Spaniards overtook some balsa rafts, aboard which they found precious metals and some of the clothes of the country, all of which they kept, so that they might take them to Spain to show the King.[8]

But even before Ruiz captured the first merchant balsa off Ecuador, the Spaniards had already heard rumours about Peruvian navigation from the natives of Panama. The chronicler Las Casas,[9] son of Columbus' companion, stated that the aborigines in Peru possessed balsa rafts in which they navigated with sails and paddles, and that this fact was also known in pre-Conquest times to the oldest son of Comogre, a great chief in Panama, who spoke to Balboa of a rich coastal empire to the south where people navigated the Pacific Ocean with ships a little smaller than those of the Spaniards, propelled by sails and paddles.

Several of Pizarro's contemporaries recorded details of the craft navigated by the coastal natives of Ecuador and northern Peru: Oviedo (1535),[10] Andagoya (1541)[11] and Zárate (1555),[12] who came to Peru as Royal Treasurer in 1543. Their similar accounts describe rafts made of "long and light logs," an odd number

7 *Idem*, p. 196.

8 Pedro Pizarro, *Relación del Descubrimiento y Conquista de los Reinos del Perú* (Colección de Documentos Inéditos para la Historia de España, vol. 5, Madrid, 1844).

9 Bartholomé Las Casas, *Historia de las Indias* (Colección de Documentos Inéditos para la Historia de España, Madrid, 1876), chapter 41, pp. 78, 79.

10 Gonzalo Fernando de Oviedo y Valdés, *Historia General y Natural de las Indias, Islas y Tierra-firme del Mar Oceano* (Madrid, 1855), vol. 4, book 45, chapter 17.

11 Pascual de Andagoya, *Narrative of the Proceedings of Pedrarias Davila . . .* (Hakluyt Society, vol. 34, 1865), p. 41.

12 Augustin de Zárate, *Histoire de la Découverte et de la Conquête du Pérou* (Original ed., Antwerp, 1555: Amsterdam, 1700), book 1, chapter 6.

—five, seven, nine or eleven—tied together with cross-beams covered by a deck; the navigation with sails and paddles; the ability of the large ones to carry up to fifty men and three horses; and the construction of a special cooking place on board. Andagoya, who took part in the earliest expeditions of discovery northward and southward along the Pacific coast, was particularly impressed by the quality of the native henequen rope ("stronger than that of Spain") and the excellent cotton canvas. In describing the ability of the local natives to navigate with regular sails, Zárate stated that the raftsmen of Tumbez in north Peru were great mariners *(grandes marineros)* who played fatal tricks on many of the Spaniards who had voyaged as passengers on their balsa rafts. The natives had simply detached the ropes holding the log raft together, and the Spaniards fell through and drowned while the cunning Indians survived because they were outstanding swimmers. Pedro Pizzaro, who accompanied his cousin during the actual discovery of the Peruvian coast, speaks of similar perils experienced by him, Alonso de Mesa, Captain Soto, and many of his other contemporaries among the conquistadores who had forced the local natives to convey them by sea by means of sail-carrying balsa rafts. Other early chroniclers, among them Cieza de Leon (1553), state that even before the arrival of the Spaniards the coastal Peruvians, who "swam as well as fishes," lured the highland Incas into the open ocean on board balsa rafts, only to undo the lashings of the logs and thereby drown their less sea-minded passengers.

The Italian traveller Girolamo Benzoni,[13] who came to Peru about 1540, published a very primitive drawing of a small-sized Peruvian balsa raft of seven logs, carrying eight Indians. In his text he states that there were rafts for navigating which were much greater made up of nine or even eleven logs, carrying sails which varied according to the size of the raft.

Garcilasso de la Vega,[14] who was of Inca descent and left Peru for Spain in 1560, devotes most of his attention to the wash-through fishing craft of reeds or rushes which were numerous and by far the dominant vessel along the Peruvian coast; he says they usually went from four to six leagues off the coast (fifteen to twenty-four English miles), and more if necessary. He adds that when the natives wanted to convey large cargoes they used the rafts of wood on which they hoisted sails when they navigated the open sea.

Father Reginaldo de Lizarraga,[14a] who came to Peru the same year Inca Garci-

13 G. Benzoni, *Historie of the New World* (W. H. Smyth, tr.; Hakluyt Society, no. 21, London, 1857: Original ed., *La Historia del Mundo Nuevo*, Venice, 1565).

14 Inca Garcilasso de La Vega, *First Part of the Royal Commentaries of the Yncas* (Hakluyt Society, vol. 1, London, 1869-71), p. 261.

14a Reginaldo d Lizarraga, *Descripcion de las Indias. Crónica sobre el Antiquo Peru, concebida y escrita entre los años 1560 a 1602* (Los Pequeños Grandes Libros de Historia Americana, ser. 1, vol. 12, Lima, 1946), pp. 32, 33.

lasso left, says of the natives of the Chicama Valley: "These Indians are great mariners; they have large rafts of light timber with which they navigate the ocean, and while fishing they remain many leagues out at sea." He also narrated how the native merchants of the Chicama Valley communicated with Guayaquil, 500 miles to the north, by means of their balsa rafts heavily laden with sea-food and other cargo.

Father Cabello de Balboa,[15] who came to Peru in 1566, learned from the Inca historians that some two or three generations before the arrival of Pizarro, Inca Tupac Yupanqui had descended to the coast, and, selecting some of the best local pilots, had embarked with a whole army upon a vast number of rafts and sailed away from the coast. He was absent for about a year. On the return of the flotilla to Peru, the Inca and his captains claimed to have visited two inhabited islands far out in the ocean. Also the chronicler Sarmiento de Gamboa[16] in 1572 recorded these Inca accounts of pre-Spanish voyages by balsa rafts to distant Pacific islands, and this famous navigator admits himself that it was the rumors of Peruvian merchant sailors with balsa rafts and the account of Inca Tupac Yupanqui's voyage of discovery which prompted him to urge the Peruvian viceroy to organize the Mendaña expedition in search of these islands, an enterprise which directly resulted in the European discovery of Melanesia and Polynesia.

The prominent early historian of Peru, Bernabé Cobo, went into considerable detail in describing the remarkable qualities of the balsa timber used for the ocean-going rafts, and also the native ability to navigate and swim. He added:

> The largest rafts used by the Peruvian Indians living near the forests, like those of the harbors of Payta, Manta, and Guayaquil, are composed of seven, nine, or more logs of balsa timber, in the following manner: The logs are lashed one to the other lengthwise by means of lianas or ropes tied over other logs which lie as cross-beams; the log in the middle is longer than the others at the bow, and one by one they are shorter the closer they are placed to the sides, in such a way that, at the bow, they get the same form and proportions as seen on the fingers of an extended hand, although the stern is even. On the top of this they place a platform so that the people and the clothing on board shall not get wet from the water which comes up in the cracks between the large timbers. These rafts navigate on the ocean by means of sail and paddles, and some are so large that they are easily able to carry fifty men.[17]

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15 Miguel Cabello de Balboa, *Miscelanea antartica* (Ms. in New York Public Library, copied from the now lost original about 1700-25); *idem*, "Histoire du Pérou" (in Ternaux-Compans, *Voyages, Relations et Mémoires Originaux pour Servir á l'Histoire de la Découverte de l'Amerique*, Paris, 1840).

16 Pedro Sarmiento de Gamboa, *History of the Incas* (C. Markham, tr. and ed.; Hakluyt Society, 2nd series, vol. 22, Cambridge, 1907).

17 Bernabé Cobo, *Historia del Nuevo Mundo . . .* (Marcos Jiménez de la Espada, ed., Sociedad de Bibliófilos Andaluces, Sevilla, 1890-95), chapter 14, p. 218.

The next crude illustration of a balsa raft under sail was drawn by Spilbergen[18] on his voyage around the world in 1614 to 1617. Spilbergen states that when this balsa raft entered Paita harbor, 120 miles south of the Peruvian port of Tumbez, its crew of five natives had been away fishing for two months, and came back with enough provisions on their raft to distribute to the whole Dutch fleet anchored in the bay. The interesting feature in Spilbergen's otherwise crude drawing of the event, is that it shows the crew in action on board the raft, two of them attending the sail, while the other three are navigating the raft without paddles or steering-oar, simply by raising and lowering center-boards inserted in cracks between the logs. The use of center-boards was an art which was completely unknown to boat-builders in Europe until about 1870, more than two hundred and fifty years later.

The first unsuccessful attempt to introduce center-board navigation to Europe was in 1736, after the Spanish naval officers Juan and Ulloa.[19] had made an interesting survey of the ingenious art of aboriginal balsa raft navigation in Guayaquil Bay. They published an excellent drawing of a balsa raft at sea, showing such details as the arrangement of the bipod mast with its sail and rigging, the thatched hut amidship, the cooking-place with open fire and the storage of water-jars astern, and the position of the center-boards inserted near the bow and stern. They claim emphatically that a native crew with sufficient skill in manipulating the center-boards could sail a balsa raft in any wind as well as a regular ship.

Five years later Lescallier[19a] published another drawing of a large nine-log balsa raft with a spacious dwelling amidship and a crew navigating at sea simply by means of center-boards and a huge square sail on a bipod mast. Lescallier's work published under order of the King of France to serve as instruction for the naval cadets, included a good description of the aboriginal balsa raft and its remarkable steering principles still employed only among its native inventors on the northwest coast of South America. With Juan and Ulloa as his main source, Lescallier emphasized that if the principles of this native center-board navigation had been known in Europe, many shipwrecked would have saved their lives by sailing their rafts to the nearest port.

In 1801 Charnock,[20] in his great history of marine architecture, made another fruitless effort to introduce the ingenious art of center-board navigation to the outside world, stating that this method of steering was an art peculiar to the coastal Indians of Peru and Ecuador and hitherto unknown in Europe.

18 Joris Van Spilbergen, *Speculum Orientalis Occidentalis que Indiæ navigation, 1614-18* (Leiden, 1619).

19 G. Juan and A. de Ulloa, *Relación Histórica del Viaje a la América Meridional . . .* (Madrid, 1748), vol. 1, p. 189.

19a M. Lescallier, *Traité pratique du gréement des vaisseaux et autres batimens de mer* (Paris, 1741), vol. 1, pp. 458-463.

20 J. Charnock, *A History of Marine Architecture* (London, 1801), vol. 1, p. 12.

Alexander Humboldt,[21] in 1810, presents a beautiful illustration in water color of a large sail-carrying balsa raft with center-board; and in 1825 Stevenson[21a] gave an excellent description of the larger balsa rafts that still covered the coast of the former Chimu habitat as far down as to Huanchaco south of Chicama. Some of these larger rafts had thatched bamboo huts with four or five rooms, and they were "beating up against the wind and current a distance of four degrees of latitude, having onboard five or six quintals [25 or 30 tons] of goods as a cargo, besides a crew of Indians and their provisions." Stevenson, too, describes the center-boards and says: "By raising or lowering these boards in different parts of the balsa, the natives can perform on their raft all the manoeuvres of a regular built and well-rigged vessel. . . ."

In an unpublished manuscript of 1840, written by George Blaxland[21b] and preserved in the Mitchell Library of Sydney, the author reproduces a drawing of a nine-log balsa raft, with sail and center-boards as the only means of navigation. The manuscript also contains a report from an officer of one of His Majesty's ships, who had encountered a native Peruvian family on a balsa raft at the island of Lobos de Afuera about sixty miles off the Peruvian coast. The natives were just preparing a raft voyage to the invisible mainland against a contrary wind: ". . . they had been absent from their Native Village three weeks, and were about to return with a Cargo of Dried Fish, the family consisted of Nine persons, with a Number of Dogs and all their goods and chattels. . . . The Vessel I was in, a schooner of 40 tons sailed for the same place in company, and it was surprising to see the manner the raft held the Wind, going at the rate of four or five knots an hour; we kept together for some time and arrived the next day within a few hours of each other; . . . The whole of the lading of vessels on some parts of the Coast is made entirely by these balsas and at Lambeyeque in consequence of the heavy surf rolling on the shore, a landing cannot be effected but by them; they also carry salt from one port to another two or three hundred miles apart, another proof they are trustworthy." In 1841 we get a detailed technical draft by Paris[22] in his essay on naval construction among non-European peoples. Paris was in South America in time to see the aboriginal Peruvian balsa rafts before they were displaced by European boat-types at the turn of the century, but he studied them only while moored in the bay. Although he carefully drew and described the center-

21 A. von Humboldt, *Vues des Cordillères, et Monuments des Peuples Indigènes de l'Amérique* (Paris, 1816).

21a W. B. Stevenson, *A Historical and Descriptive Narrative of Twenty Years' Residence in South America* (London, 1825), p. 223.

21b George Blaxland, *Treatise on the Aboriginal Inhabitants of Polynesia with evidence of their origin and antiquity* (Ms. loc. no. B760, Mitchell Library, Sydney).

22 F. E. Paris, *Essai sur le Construction Navale des Peuples Extra-Européens* (Paris, 1841-43).

boards, or *guaras* as they were termed by the natives, he did not fully understand their technique or function, stating merely that: "These are driven in to a greater or lesser degree, fore or aft, in order to luff or go about. The rafts have no other methods for steering on the ocean. . . ."

It is quite obvious that a *guara*, or center-board, as opposed to a paddle or steering-oar, can only be used in connection with a sail. Without a sail a center-board has no function and no effect. This has already been pointed out by Lothrop[23] and others, and is an important fact in view of the many center-boards which are found archaeologically in the desert graves on the north and south coast of Peru. The beautifully ornamented hardwood center-boards from the numerous graves of Paracas and Ica in southern Peru show that sail-carrying rafts were important culture elements even in these southern latitudes, and at periods which not only antedate written history, but even take us right back into pre-Inca time. Bennett,[24] for instance, illustrates one of these beautifully carved and painted center-boards from the south coast of Peru. Archaeology also furnishes us with some minor but rather important details which remained unrecorded by the early chroniclers and historic observers, namely, how the lashings were secured to the slippery logs, and how the individual logs were shaped in the bow and stern to diminish the water resistance. Such information may be gained from the tiny model rafts—more properly intended as spirit-rafts—which have been found in great numbers in the Arica desert graves still farther south on the coast. These prehistoric rafts were left there more than a thousand years before the arrival of Pizarro and the first Europeans, and show that the lashings, of hemp-rope or strips of seal hide, were fastened in grooves cut around the logs. They also show that to decrease the water resistance each log was pointed boat-fashion fore and aft. One small raft excavated by Uhle[25] and published in 1922 was fitted with a square sail of reeds similar to that used until the present day by the neighboring mountain Indians of Lake Titicaca. It was this discovery in a grave from the primitive fisher population at Arica, dated to the first centuries AD, which made Nordenskiöld[26] conclude that "The sail was probably known on the Peruvian coast earlier than pottery and weaving. . . ."

As earlier quoted from Inca Garcilasso, the most numerous craft along the desert coast of aboriginal Peru was the reed-raft of the individual fishermen; the wooden rafts with sail were only used for transporting heavy cargo and for regular

23 *Op. cit.*, p. 240.

24 W. C. Bennett, *Ancient Arts of the Andes* (New York, 1954), figs. 89, 90.

25 M. Uhle, *Fundamentos Étnicos y Arqueologia de Arica y Tacna* (Universidad Central, Quito, 1922), p. 49.

26 E. Nordenskiöld, *Origin of the Indian Civilizations in South America* (Comparative Ethnographical Studies, vol. 9, Gothenburg, 1931), p. 265.

ocean voyaging. The principal Peruvian ports for wooden rafts in Inca time were Paita and Tumbez and other villages, on the northern coast near the great balsa forests of Ecuador, but until 1900 important balsa raft ports were recorded as far down as Sechura, Lambayeque, Pacasmayo, and Huanchaco, 500 miles south of Guayaquil. In Inca time the balsa rafts were employed still another 500 miles to the south, conveying guano for fertilizer from the Chincha Islands near Pisco to the various provinces of Peru. The Incas even transported balsa logs overland for the construction of buoyant rafts in remote corners of their empire. Thus, when the first Spaniards under Hernando Pizarro advanced down the highland of the Andes from Cuzco, they found in what today is Bolivia great quantities of large balsa timber transported there on the backs of native laborers to build wooden balsa rafts on Lake Titicaca for the pleasure of Inca Huayna Capac.[27]

By combining historical and archaeological information, we thus possess a fairly accurate knowledge of the construction principles and local importance of the peculiar raft which permitted aboriginal navigation in Peru and adjacent Pacific waters. Thus, when the noted Americanist S. K. Lothrop in 1932 compiled material for his interesting paper on *Aboriginal Navigation off the West Coast of South America* he was able to give a good picture of the local balsa raft. However, in judging its sea-going ability, he stated that it "absorbs water rapidly and loses its buoyancy completely after a few weeks. Owing to this characteristic it was necessary to take the *Jangada* [or balsa raft] apart at intervals, haul the logs ashore, and there allow them to dry out completely."[28] Lothrop concluded that the balsa raft was unfit for oversea voyages, and that it could not travel as far as to the Pacific islands, not even to the Galapagos group a few hundred miles off shore.

Lothrop quoted Byam as his source for this information. Byam,[29] however, was a 19th century British traveller who was unacquainted with balsa rafts. In his book of 1850 we find that his sailing ship met a seafaring balsa raft off Cabo Blanco in north Peru. The raft is described as merely sighted in the distance, while tacking southwards against a fresh breeze, and whatever additional information Byam gave concerning its buoyancy was merely quoted as the opinion of the captain on his ship.

Lothrop's study was otherwise a valuable contribution, and few anthropologists have afterwards cared to penetrate farther into the question. Some additional material was brought up by the noted Inca authority P. A. Means[30] in 1942, in his

27 V. Valverde, *Relación del Sitio del Cuzco y Principio de las Guerras Civiles del Pêru . . . 1535 a 1539* (Colección de Libros Espanoles Raros o Curiosos, vol. 13, Madrid, 1879), p. 179.

28 *Op. cit.*, p. 238.

29 G. Byam, *Wanderings in Some of the Western Republics of America . . .* (London, 1850), p. 200.

30 *Op. cit.*, pp. 15, 18.

interesting paper *Pre-Spanish Navigation Off the Andean Coast,* but referring in part to Lothrop, Means accepts the same negative view in his theoretical judgment of the balsa raft, saying: "it was obviously a type of boat that would awake nothing but scorn in the breasts of shipbuilders of almost any other maritime people in the world." He concludes:

> Altogether, we are justified in concluding that in Peruvian native navigation prior to the Spanish conquest, the balsa-log raft, with sails, deck-house, and cargo-space, was the least contemptible and the least inefficient type of craft known. This, admittedly, is faint praise; but, in view of the facts, it is the best that can be given to the boat-building art of those singularly unmarine-minded people, the ancient Andeans.

The noted authority on aboriginal craft and navigation, J. Hornell, was led to bring up the same subject in 1945, first in his paper, *Was there a Pre-Columbian Contact between the Peoples of Oceania and S. America?*[31] And next in 1946 in his paper *How did the Sweet Potato reach Oceania?*[32] Hornell was confident that the early Peruvians had influenced the Polynesian island agriculture, and was therefore careful in his judgment of the balsa raft, yet he concludes:

> Certainly no ordinary, untreated balsa raft could make a prolonged oversea voyage unless the Inca's seamen knew of an effective method of treating its absorbent logs with some kind of waterproofing composition. . . .

The confident attitude among the Americanists who had actually surveyed the main principles in Peruvian boat-building had a double effect on modern anthropology. By labelling the balsa raft as "not seaworthy," the aboriginal Peruvians were deprived of their principal means of navigation and generally deemed a notedly unmaritime and land-locked people. This one-sided picture of the early high-cultures in Pacific South America penetrated the technical as well as the general literature, and it soon biased the study of important problems in Polynesian anthropology.

In 1932 the prominent Pacific scholar R. B. Dixon[33] succeeded in proving that the sweet potato had been carried by man from Peru to Polynesia in pre-Spanish time, accompanied by its Quechua-Peruvian name *kumara,* and pointing to the balsa rafts, he suggested that Peruvian or other American Indians had been responsible for the transfer. In the same year Lothrop published his aforesaid survey of Peruvian navigation, and two years later Dixon came back with a new publication[34] stating:

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31 *Loc. cit.*

32 J. Hornell, *How Did the Sweet Potato Reach Oceania?* (Journal, Linnaean Society, London, vol. 53, no. 348, London, 1946).

33 R. B. Dixon, *The Problem of the Sweet Potato in Polynesia* (American Anthropologist, vol. 34, 1932).

34 R. B. Dixon, *The Long Voyages of the Polynesians* (Proceedings, American Philosophical Society, vol. 74, no. 3, 1934).

Since we have no evidence that at any time the Indians of the Pacific Coast of South America where the sweet potato was grown, had either the craft or the skill for making long sea journeys, we are forced to conclude that the transference of the plant was carried out by Polynesians.

Correspondingly, in 1933 the noted Polynesian archaeologist, K. P. Emory,[35] wrote with regard to the ancient great-stone masonry of Easter Island, the Society Islands, the Marquesas, Hawaii, Tubuai, and the Tonga group:

> It is quite within reason to entertain an American origin for a cultural element so specialized as this stone facing. It is a conspicuous element localized in the part of America nearest to Polynesia, a part where currents strike out and flow in the direction of Easter Island and the Tuamotus. . . . May not one of the seagoing rafts of the early Incas have been swept into this current carrying survivors as far as Easter Island 2000 miles to the west?

In a subsequent publication of 1942[36] he also was led to abandon his view, since, as he states, Dixon had in the meantime pointed out to him that the balsa raft of Pacific South America quickly became waterlogged. In a publication by Morgan[37] of 1946 the author in turn quotes Emory who wrote to him on request that "Balsa rafts become waterlogged in a few days if not taken out of the water to dry."

At this time the verdict on the balsa raft had virtually grown into an axiom, and when Buck[38] in 1945 published his *Introduction to Polynesian Anthropology*, he eliminated one half of the Pacific border-lands by simply stating:

> Since the South American Indians had neither the vessels nor the navigating ability to cross the ocean space between their shores and the nearest Polynesian islands, they may be disregarded as the agents of supply.

With the same confidence Weckler[39] wrote in 1943 in his monograph on *Polynesian Explorers of the Pacific* that: "no American Indians had sea-going ships that were capable of such passages as the voyage to Polynesia."

This belief had such a firm grip on the minds of both Americanists and Pacific anthropologists, that, when I attempted to oppose it in a publication of 1941,[40] naturally I met no response. There appeared to be in the end only one way to settle

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35 K. P. Emory, *Stone Remains in the Society Islands* (Bulletin, B. P. Bishop Museum, no. 116, Honolulu, 1933), p. 48.

36 K. P. Emory, *Oceanian Influence on American Indian Culture: Nordenskiöld's View* (Journal, Polynesian Society, vol. 51, 1942), p. 129.

37 A. E. Morgan, *Nowhere Was Somewhere* (New York, 1946), p. 80.

38 P. H. Buck, *An Introduction to Polynesian Anthropology* (Bulletin, B. P. Bishop Museum, no. 187, Honolulu, 1945), p. 11.

39 J. E. Weckler, *Polynesian Explorers of the Pacific* (Smithsonian Institution War Background Studies, no. 6, Washington, 1943), p. 35.

40 *Loc. cit.*

the dispute, namely to construct a replica of the craft under discussion, and to derive a satisfactory answer through a practical test. Therefore, in 1947, I organized and led what became the Kon-Tiki expedition.

The raft, named Kon-Tiki, was composed of nine two-foot-thick balsa logs, ranging in length from thirty to forty-five feet, the longest in the middle, and lashed to cross-beams supporting a bamboo deck and an open hut. A bipod mast, carrying a square sail, five *guaras* (center-boards), and a steering-oar completed the construction. The raft was launched off Callao harbour in Peru on April 28 with a crew of six men; ninety-three days later the first inhabited Polynesian island was sighted, and passed. After a total journey of 4300 miles in 101 days, Kon-Tiki grounded on the reef of Raroia Atoll in the Tuamotu Islands, with crew and nearly all the cargo safe.

The object of the expedition had been to test and study the true qualities and abilities of the balsa raft, and what was more, to get an answer to the old and disputed question whether or not the Polynesian islands were within feasible reach of the raftsmen of ancient Peru.

It proved to be an exceedingly seaworthy craft, perfectly adapted for carrying heavy cargoes in the open and unsheltered ocean. Of all the valuable qualities none surprised and impressed us more than its outstanding safety and seaworthiness in all weather conditions at sea. Next to its unique ability to ride the waves came perhaps its carrying capacity, which, however, was no surprise, since balsa rafts capable of carrying up to thirty tons were described by the early Spaniards.

The theoretical judgments of the balsa raft had deemed it not seaworthy because of the water-absorbent nature of the balsa wood, which would make it sink if not regularly dismantled and dried; also because it was thought that the rope lashings which kept the logs and the whole craft together would be worn through by friction when the great logs began to move at sea. The light and porous wood was also considered to be too fragile should high ocean seas lift the bow and stern up while crew and cargo were weighing upon the central part. Finally, it was considered that a one and a half foot freeboard on the flat and open raft would leave crew and cargo entirely exposed to the ocean seas.

Our experience provided the answer to these problems, and showed that the ancient culture peoples of Peru and Ecuador had their good reasons for evolving —and abiding by—this very type of deep-sea-going craft.

Dry balsa wood, as commercially distributed and generally known today, is exceedingly water-absorbent and unsuitable for raft construction, but green balsa wood, put into the sea when freshly cut and still filled with sap, is very water-resistant, and although the water gradually penetrates the sun-dried outer section, the sap inside prevents further absorption. Kon-Tiki was still capable of holding

tons of cargo when it was finally pulled ashore for preservation more than a year after the expedition.

The balsa logs did not chafe off the rope lashings. The reason was that the surface of the logs became soft and spongy, and the ropes were left unharmed as if pressed between cork. The two-feet-thick balsa logs proved to be tough enough to resist the assault of two storms with towering seas, and even an emergency landfall on an unsheltered reef in Polynesia.

The secret of the safety and seaworthiness of the unprotected balsa raft, in spite of its negligible freeboard, was primarily its unique ability to rise with any threatening sea, thus riding over the dangerous water-masses which would have broken aboard most other small craft. Secondly it was the ingenious wash-through construction which allowed all water to disappear as through a sieve. Neither towering swells nor breaking wind-waves had any chance of getting a grip on the vessel, and the result was a feeling of complete security which no other open or small craft could have offered. Moreover the shallow construction of the raft, and the flexibility allowed by all the independent lashings, made it possible even to land directly on an exposed reef on the windward side of the dangerous Tuamotu archipelago.

During the voyage a few experiments were carried out with what the natives call *guaras*, the aforesaid center-board. It was found that five *guaras*, six feet deep and two feet wide, when securely attached, were enough to permit the raft to sail almost at right angles to the wind. It was also ascertained that by raising or lowering a *guara* fore or aft, the raft could be steered without using the steering oar.

However, an attempt to tack into the wind failed completely, and the raft's crew therefore yielded to the generally held claim that the Peruvian balsa-raft, like just any other flat-bottomed raft, could only be sailed in the general directions of a following wind. But subsequent to the expedition the present author was gradually led to suspect[41] that this failure in our attempt to tack was probably due to the inexperience of the raft's crew rather than to limitations in the early Peruvian marine architecture, and in 1953 the experiment was renewed. Mr Emilio Estrada of Guayaquil kindly arranged for the building of a smaller test raft constructed like Kon-Tiki of nine balsa logs lashed together and covered by a bamboo deck. Likewise, for navigation, a square sail was hoisted on its usual bipod mast in native fashion, and similarly six *guaras* were inserted between the logs, two in the extreme bow and two in the stern. No paddles, rudder, or steering-oar were carried on the raft, which was launched from the open coast of Playas, Ecuador, with a crew of four. Our suspicion was verified: a correct interplay between the handling of the

41 T. Heyerdahl, *American Indians in the Pacific: the Theory Behind the Kon-Tiki Expedition* (London, 1952), p. 606.

sail and the *guaras* fore and aft enabled us, after some experimentation, to tack against contrary wind, and even to sail back to the exact spot where we had set off. The *guara* method of steering a raft was astonishing through its simplicity and effectiveness,[42] and the ingenious technique involved may even be adopted with great benefit on modern life-rafts which are entirely unnavigable.

With the ability to sail and tack their capacious and seaworthy balsa rafts, through the pre-Inca invention of *guara*-navigation, the early Peruvian high cultures were very far advanced in marine matters, and an entire reappraisal of early Peruvian seamanship and navigation is necessary.

Some of the rafts actually seen by the earliest Europeans off the Andean coast carried merchants with their women and tons of cargo on board. Others were used for army transportation and the conquest and control of warlike islanders off the empire coast. Still others were used by the fishermen who went on extensive expeditions of long duration in the rapid currents and eddies of the Humboldt Current. The Spaniards even recorded Inca memories of individual merchant rafts and large organized raft flotillas that set out on direct exploring expeditions to very remote islands.

Thus, the fact that Andean watercraft was based on boat-building principles alien to our ancestors, and therefore distrusted and underestimated by us, should not be permitted to bias our judgment of the vast and diversified aboriginal population of the area. Among the local tribes and nations there were men and women who were sea-minded rather than land-locked, and who founded their existence on a long-lasting and thorough marine tradition on the northwest coast of aboriginal South America.

Oslo, Norway

42 T. Heyerdahl, *En Gjenoppdaget Inka-kunst: Guara-metoden som lar flåter krysse og jibbe uten ror eller styreåre* (Teknisk Ukeblad, n.r., vol. 48, Oslo, 1954), p. 1039.

IRRIGATION IN THE OLD ACOLHUA DOMAIN, MEXICO[1]

ERIC R. WOLF AND ÁNGEL PALERM

INTRODUCTION

IN 1861, Sir Edward Tylor reported on his visit to the Hill of Tetzcutzingo—situated east of the town of Texcoco in the Valley of Mexico—in the following words:

> We did not go first to Tetzcotzinco itself, but to another hill which is connected with it by an aqueduct of immense size, along which we walked. The mountains in this part are of porphyry and the channel of the aqueduct was made principally of blocks of the same material, on which the smooth stucco that once had covered the whole inside and out, still remained very perfect. The channel was carried, not on arches, but on a solid embankment a hundred and fifty to two hundred feet high, and wide enough for a carriage road.[2]

He concluded from this visit that

> the ancient Mexicans were not, it is true, to be compared with the Spanish Arabs or the Peruvians in their knowledge of agriculture and the art of irrigation, but both history and the remains still to be found in the country prove that in the more densely populated parts of the plains they had made considerable progress.[3]

In the summer of 1954, the present writers began a study of the ecology of the area which Tylor described above.[4] We soon discovered that the works of the Tetzcutzingo formed only a small part of a much larger pre-Hispanic system of irrigation. Parts of this system are used by the inhabitants of the area to this day. In this paper we hope to present the essential data collected during our brief survey, and to discuss the theoretical issues raised by them.

The Old Acolhua domain—within which the Tetzcutzingo is situated—extends from the eastern shoreline of Lake Texcoco into the sierra which divides the Valley of Mexico from the valleys to the east. Work in this region offers a great challenge to the modern anthropologist. The analysis of rich archaeological remains tests his archaeological skills; an abundance of pre-Hispanic and post-Conquest documents require historical imagination and linguistic ability for proper interpretation; and

1 Parts of this paper were read at the 53rd Annual Meeting of the American Anthropological Association at Detroit, on Dec. 30th, 1954.

2 Tylor, 1861, p. 152.

3 *Idem*, p. 159.

4 We wish to acknowledge the aid of the Wenner-Gren Foundation for Anthropological Research in making a travel grant to Sr Palerm, and the helpful coöperation shown us by the Instituto Nacional de Antropología e Historia, directed by Arq Ignacio Marquina.

his ethnological techniques are required to study the present-day and fully-functioning system of irrigation with its roots in the pre-Hispanic past. In an era of increasing specialization, the anthropologist can here employ the repertory of his specialized techniques in a study of culture as a whole.[5]

MODERN SETTLEMENT AREAS

We may divide the area under discussion roughly into four major ecological belts.

The Sierra. The highest of these is the sierra, rising to the east above the 2,750 m (9,075 ft) contour towards its highest point in the immediate area, Mt Tlaloc (13,270 ft). This sierra forms part of the continental divide, and separates the Valley of Mexico from the Valleys of Puebla and Tlaxcala. At the foot of the sierra, just below the 2,750 m contour lies a fringe of villages. These are, from north to south: Santo Tomás Apipilhuasco, San Juan Totolapan, San Gregorio Amanalco, Santa María Tecuanulco, Santa Catarina del Monte, and San Pablo Ixayoc.[6] Between San Juan Totolapan and San Gregorio Amanalco are located the springs of San Francisco which feed the larger part of the irrigation system today and probably did so in the past. The main spring supplying the southern canals, called Texapo, issues on the slopes of Mt Quetzaltepec above San Pablo Ixayoc.

Each of these sierra communities has a church and a small plaza, but dwelling units are widely scattered, each house with its garden, vasiform granary, and sweatbath standing apart from the others. Crops are grown on levelled plots of uneven dimension *(bancos)*, hedged about by maguey plants. The main food crops are wheat and corn, both of which are grown primarily for subsistence. Barley and rye are also grown. Wheat is preferred since it resists frosts and is thus more secure than corn. A few flowers are grown for sale in valley towns, but *pulque*—produced from the maguey—and wood burned to charcoal are the main products sold for cash in the lower piedmont and flatland communities. Some hunting is carried on for both food and pleasure.

The system of landed property in the sierra communities must receive further study. Most land seems to be held as *ejidos* by the villages enumerated. Santa Catarina del Monte owns its forest land as part of its *ejido*. Santa María Tecuanulco, on the other hand, does not possess *ejido* land.

Arid zone. Below the sierra villages lies a belt of arid and eroded country, extending roughly from the 2,750 m (9,075 ft) contour to the lower 2,500 m (8,250

5 Strong, 1936, p. 367.

6 The earlier name of Santa Catarina del Monte seems to have been Sochitiapan or Xochihuacan. San Pablo Ixayoc is so listed on all maps and government documents, but should probably read San Pablo Ixayotl.

ft) contour. Bare of dwelling units and settlements today, it was heavily populated before the Spanish conquest, and the more impressive earth works built in connection with irrigation are found here. These will receive further discussion below.

Piedmont. Where the hills descend to the flat land of the lake shore at the 2,500 m (8,250 ft) contour, we find another cluster of village communities. These piedmont communities, running from north to south, are San Juan Tezontla, Sta Inés, San Joaquín Ixtlilxóchitl, Purificación (formerly Tepetetitla), San Miguel Tlaíxpan, San Nicolás Tlaminca, Santa María Nativitas, San Diego Nativitas, and Tequesquinahuac. These piedmont villages grow corn for subsistence and flowers for sale in Mexico City flower markets. Fruit trees are cultivated, and fruit is sometimes sold, sometimes bartered for such lake products as moth eggs *(ahuauhtli)* collected by the people on the lake shore. San Joaquín Ixtlilxóchitl resembles the flat land communities in possessing an artisan specialty, the production of powder for fireworks.

Cultivation seems to be much more intensive in the piedmont than in the sierra, and agricultural methods show greater care. Especially at San Miguel Tlaíxpan and San Nicolás Tlaminca, agriculture is carried on on irrigated terraces (sing. *kalálli;* pl. *kaláltin*), carefully built of adobe and stone. Plants are allowed to mature in seedbeds before transplanting. Flowers raised for the market are covered to protect them against frost. Animal fertilizer is collected and in general use. Water distribution is handled by a communal body of water commissioners *(regidores de agua)*, and each landowner receives water once every Mesoamerican month of twenty days. The amount of water distributed to each person depends on the size of the terraces owned by him. Small storage tanks, situated on the terraces, are used to conserve water for household use. It is interesting to note that absence from the weekly communal work *(faena)* is punishable by withdrawal of water rights for the following period of distribution.

In comparison with the sierra villages, dwelling units in the piedmont communities tend to cluster around the church and plaza, but the settlement pattern in general still shows more dispersion than in the flat land below. At San Miguel Tlaíxpan and San Nicolás Tlaminca, houses are usually located on or near agricultural terraces.

Land ownership in these communities represents a complex picture, and many of its aspects must await further research. At San Miguel Tlaíxpan and San Nicolás Tlaminca agricultural terraces are privately owned. One informant reported that a house and the terraces owned by the house owner form an indissoluble complex, and that both carry the same name. *Canoatitla,* for instance is both the name of a house and of the terraces associated with the house. According to the same source, one cannot be sold without the other. A similar linkage of house and

fields has been reported by Redfield for the Nahua of Tepoztlán,[7] although this is denied by Lewis.[8] In both cases we may be dealing either with a reflection of an earlier custom when membership in the community may have been based on rights to land within the community, or simply with an ideal norm serving to restrict transactions of landed property. Whatever the case, today terraces are certainly subject to sale and purchase, and members of neighboring communities can acquire land in San Miguel Tlaíxpan or San Nicolás. While terraces and irrigated land are privately owned, the fields watered by rainfall only, which dip down from the village to the flat land below, are owned by the community as *ejido* lands.

The flat shore land. The flat shore land is characterized by three kinds of building clusters. Close to the piedmont villages are a number of haciendas and fulling-mills constructed during the colonial period. They were apparently built on lands which belonged to the piedmont communities and appropriated some of their water supply. These are La Blanca, el Batán, and Molino de Flores.

The Indian communities of the flat belt are tightly nucleated settlements, in strong contrast to the piedmont and sierra villages. Various kinds of craft production supplement or overshadow the production of maize. The best-known of these artisan communities is probably San Miguel Chiconcuac, famous for its sarapes. These Indian communities are entering into competition for land, labor, and water supply with a growing number of dairy farms that are making inroads into the area. The flat belt is well on the way to becoming part of the dairy belt of Mexico City.

MODERN IRRIGATION

The whole area is tied together by a network of irrigation canals, and by common dependence on the springs of the sierra where the water originates. The major springs of San Francisco at the northern extreme of the area are carefully guarded by the villagers of San Gregorio Amanalco against outside intruders, and in popular belief also receive the protection of supernatural guardians of the water (sing. *anáki*, pl. *anáke*) who punish disturbances of the springs with madness and disease.

Shortly below the springs, the original canal divides in two. A northwestern branch flows through three piedmont communities—San Juan Tezontla, Santa Inés and San Joaquín Ixtlilxóchitl—down into the flat land to water Blanco, San Toribio Papalotla, San Miguel Chiconcuac, and others. The piedmont communities can divert or cut off the flow of water during periods of serious water shortage.

7 Redfield, 1930, p. 145.
8 Lewis, 1951, p. 126.

The southwestern branch of the same canal flows through the three sierra communities of San Gregorio Amanalco, Santa María Tecuanulco and Santa Catarina del Monte. At Tecuanulco a separate spring feeds into the system. When the canal reaches the piedmont, it divides in turn. One branch of this second canal feeds Purificación. The other branch is dammed up and stored temporarily in two small reservoirs, called locally Ocotochco and Apancingo. The water in both reservoirs is now impounded by concrete dams of recent local construction. Further inquiry might determine the manner of their construction before they were rebuilt. It is possible that before reconstruction they were controlled by barriers of vertical posts, branches, and earth fill similar to the one located by Pedro Armillas and ourselves in the Valley of Teotihuacán.[9]

San Pablo Ixayoc and Tequesquinahuac, as well as the villages on the southern side of the Tetzcutzingo, receive their water from the well Texapo, located on Mt Quetzaltepec. A branch from this southern system also supplies Huexotla, on the southern frontier of the Old Acolhua domain.

PRE-HISPANIC SITES AND WATER WORKS

The strategic archaeological sites lie at the juncture of the piedmont with the flat land below. They are associated in the main with two mountains which stand out prominently from the chain of foothills of which they form a part. The first of these—Mt San Joaquín—is situated in the north of the area. The second—the Hill of the Tetzcutzingo already mentioned—is situated in the south.

The Mt San Joaquín Complex. Mt San Joaquín is formed by a smaller knoll extending to the northwest and a large mountain mass, running from northwest to southeast. On the smaller knoll, we located an artificial mound topped by a small round platform. It can be approached over a series of terraces which give way to a large round platform and a series of partly destroyed steps.

The saddle which links this knoll with the main mass of the mountain is carefully terraced. The remains of a canal roughly 2,000 yards long follow the western slope of the main mountain mass and linked these terraces with an aqueduct located at the southeastern extremity of the mountain. The canal was shored up by three retaining walls, which are still visible in parts. The aqueduct is 1,090 yards long, 13 yards wide at its widest point, and 13 yards high at its highest. Its northern terminus is marked by a small artificial mound, locally called Texalco. Both aqueduct and large canal have been abandoned, but the pre-Hispanic canals approaching the aqueduct are still in use to carry water to Purificación. The aqueduct itself may be the one mentioned in the *Titles of Tetzcotzinco* in the following

9 Armillas, Palerm, and Wolf, 1955.

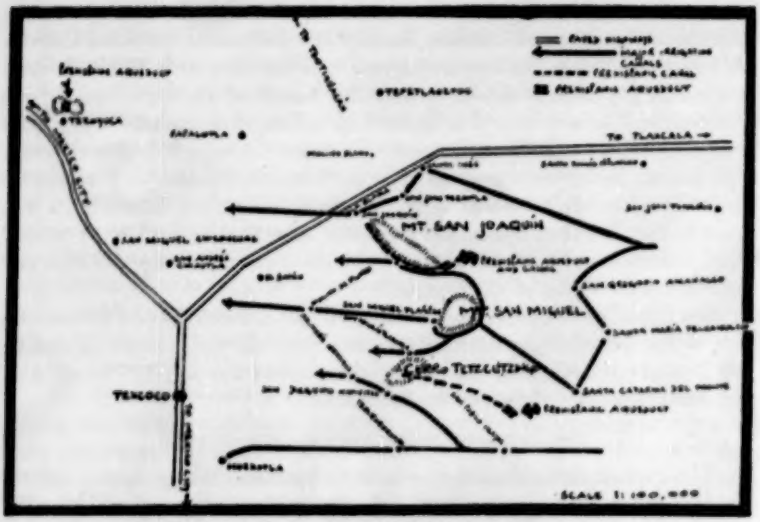

FIG. 1. Sketch map of the Old Acolhua domain.

words: "Third, Mt. Quauhyacac. All of it [water] is borne around the back of the hills in an aqueduct."[10]

The artificial knoll and the associated platforms and terraces on Mt San Joaquín suggest a ceremonial center or an upper class residence surrounded with a ceremonial aura. The round platforms would seem to link the site with the worship of the god Quetzalcoatl.[11] Religious significance may also have been ascribed to the numerous caves which dot the mountainside. The association of constructions and caves makes it not impossible that Mt San Joaquín was the *Quauhyacac* of the codices, in whose caves the kings of the Chichimec dynasty were buried.[12]

10 McAfee and Barlow, 1946, p. 113. Something should be said here about this document. It records in Nahuatl the water grants made by King Netzahualcoyotl to his lords, grants reconfirmed in part as the property of the town of Santa María Nativitas in 1537. It proved an invaluable guide to us in our survey of the area.

11 Motolinía, 1951, pp. 104-105.

12 The identification of Quauhyacac presents a problem, since the term seems to be used sometimes to designate a specific mountain, sometimes a larger mountain group. The sign for Quauhyacac in the *Codex Tlotzin* seems to refer to a specific place. Pomar (1941, pp. 53-54) refers unequivocally to "cuauhyacatl, which means foothills," thus giving the term its general meaning. The *Titles of Tetzcotzinco* seem to refer alternately to the specific and the general

The water works and the agricultural terraces with which they are connected are located so far up the mountain, however, that they seem to have been built to supply food and water to the occupants of the mountain when these could not be supplied from the flat land below. This suggests that we are dealing not only with a ceremonial center, but also with a military strong point. This suggestion receives support from the geographic location of the mountain. Mt San Joaquín and the western hill at Tezoyuca—situated directly northwest of it—form ideal defensive positions against possible inroads from the Valley of Teotihuacán to the north, from Tlaxcala to the east, and even from the southern borders of the Old Acolhua domain. We should not forget that the political dominance of Texcoco was challenged by its southern neighbors at Coatlíchan and Chalco during the formative phases of the Texcocan state. The hill at Tezoyuca seems to have been surrounded by a defensive system of ditches and escarpments. Its occupants were supplied by a small aqueduct, today badly destroyed, which ran from west to east toward the saddle between the twin hills. This is probably the aqueduct mentioned in the *Titles* as "the aqueduct which skirts the hill" at "Tezoyuca, where Cuauhyacac forms a neck."[13]

The Tetzcutzingo Complex. South of Mt San Joaquín and directly across from it lies the Hill of the Tetzcutzingo, once the favorite retreat of the kings of Texcoco, and especially of King Netzahualcoyotl whose name is associated with the so-called Baths of the King on the western side of the hill.[14]

According to Ixtlilxóchitl,[15] the Tetzcutzingo was

> The most agreeable of the gardens [of King Netzahualcoyotl] and the one most filled with sights . . . because it not only had a large winding path which permitted people to climb to the top and to walk all over it, but was also terraced, with some terraces built of mortar and others hewn into the very rock; and to lead the water from its spring to the wells, fountains, baths and canals which distributed it to irrigate the flowers and tree clumps of this wood, a strong and very high wall of mortar had to be built from one mountain to the next, at incredible height, to support a canal which led to the very top of the woods.

Padre Dávila[16] gives further details:

> Due to the industry and greatness of the Kings of Tezcuco water was brought in canals over a distance of two leagues to irrigate the hill; mountains were levelled and

meaning of the term. Thus they state: "Third, Mt. Quauhyacac" where an aqueduct is located (see above), yet seem to extend the term when they speak of "Tezoyuca, where Cuauhyacac forms a neck" (*idem*, p. 114). There the meaning seems to be "Where the chain of foothills where we have our defenses protrudes into the plain." See footnote 13.

13 McAfee and Barlow, 1946, p. 114. See preceding footnote.

14 Niekler, 1919-22; Mendizábal, 1946.

15 Ixtlilxóchitl, 1891, vol. 2, p. 210.

16 Dávila, 1625, p. 619.

valleys filled to allow the water to flow under its own power until it reached the very top of that hill, where it was allowed to spiral down to irrigate all the trees and plants as it has done until today.

The canals for this "royal town of Tezcotzinco . . . all full of fine obsidian, of jade bracelets . . . of gold"[17] were fed through two aqueducts. The first—rediscovered by Pedro Armillas—is about 327 yards long, 22 yards high at its highest point, and 44 yards wide at the widest; and located at a place called Amanalco north of San Pablo Ixayoc. The contingent canals are nearly all destroyed, but enough traces remain to reconstruct their course. They apparently ran along the southern contour of the hills which extend out to the Tetzcutzingo, "whereby it came alongside Chiconquiauitl, thence straight alongside Tetecatl (Metecatl) [still the name of the hill immediately behind the Tetzcutzingo; ERW and AP] thence by Tetzcotzinco."[18] The aqueduct which connected Tetzcutzingo and Metecatl is the one described by Tylor in the paragraphs cited at the beginning of this paper. Then, as now, Huexotla does not seem to have formed an integral part of the system. Netzahualcoyotl left the decision to supply Huexotla to the discretion of his lords Tlazolyahuitl and Maxiuitl. "And the Quetzaltepec water," he is quoted as saying,[19] "perhaps Huexotla will ask . . . for a little, and when you want it you may have it, because it is your water, your property." Huexotla was in fact located in the border area between the Old Northern Acolhua domain and the southern Acolhuacan, and in disputes between the two areas before the final consolidation of the Texcocan state seems to have formed unstable and changing alliances with one or the other.

Terracing. In a number of places, the irrigation canals and aqueducts were associated with terraces which are today abandoned. Remains of such terraces are best preserved on the reverse eastern slopes of the piedmont, though they may have been more widespread in the past and their traces wiped out by erosion. Such terraces are found on the northeastern slope of Mt Cocotl, the third cone in the line of hills ending in the Tetzcutzingo; on the reverse slope of Mt San Miguel; and on the eastern side of the aqueduct leading to Mt San Joaquín (called Hueytlalli, "big land," by local informants). The terraces on the reverse slope of Mt San Miguel are located above the present-day canals, thus indicating that the water level was higher at the time of their construction.

Pre-Hispanic patterns of settlement. We can predict on purely theoretical grounds that the introduction of irrigation will tend to increase agricultural productivity which will lead in turn to an increase in population. In fact, the systems

17 McAfee and Barlow, 1946, p. 114.
18 *Idem*, p. 115.
19 *Ibid.*, and again p. 116.

described here must have supported a pre-Hispanic population of great density. The eroded arid belt between the sierra and the piedmont contains enormous quantities of sherds of domestic pottery and numerous traces of domestic construction. The accumulation of such a large number of sherds during what seems to have been a relatively short period of time thus points to a large population where there is not even an isolated settlement today.

The main settlement areas associated with irrigation seem to have been three in number. The first extended from Mt Cocotl behind the Tetzcutzingo to Amanalco where the aqueduct was located. The second ran from the aqueduct near Mt San Joaquín to within a mile of Santa María Tecuanulco. The third was located between Santa Inés and San Gregorio Amanalco. House sites seem to have been located along the crests of ridges, with fields falling off gradually along the slopes up to the point where these fell off steeply into the deep ravines between the crests.

Age of the Pre-Hispanic System. Two kinds of evidence, pottery and historical documents, may be used to arrive at a rough date for the construction of the system. All sherds collected in the area indicate pottery of Aztec III and IV types. These belong to the century preceding the Spanish Conquest. No pottery belonging to an earlier period has so far come to light in the vicinity of the water works. This late date is supported by the *Titles of Tetzcotzinco.* In this document King Netzahualcoyotl addresses his lords in the following words:[20]

> Let the Chichimeca assemble and go and take the springing water. It rises in Yelloxochitlán, in truth, it is there; fetch it hither. And by virtue of your blood you will obtain it so as to bring it here so as to guide it here, by your toil you will fetch it in order to work in my town, Tetzcotzinco.

This seems to indicate that the system was constructed in association with the royal residence at Tetzcotzinco. The year Tetzcotzinco was built is given in the *Códice en Cruz* as 1 Rabbit, or 1454.[21]

Motives for the Construction of the System. The entire history of the Acolhua domain is characterized by a strong tendency to intensify food production. We have shown elsewhere[22] that the central political problem of the Texcocan state consisted in establishing the dominance of "Toltec" economic, social, and political patterns over the purely predatory patterns of the "Chichimecas." The kings of the Chichimec dynasty made every effort to force the Chichimeca to adopt the ways of the resident Toltec population by forcing them to carry on agriculture, to change their diet to include more agricultural products, and to settle in nucleated

20 *Idem*, p. 112.
21 Dibble, 1941, p. 43.
22 Palerm and Wolf, 1954. A larger study of this problem is in preparation.

villages. On the other hand, they protected the Toltec agriculturists, married into their noble families, and added to the strength of the Toltec sector by furthering continuous settlement of Toltec groups in their domain. The construction of the Texcocan systems of irrigation thus seems to represent merely the culmination of a long-established trend.

If our estimate of when the system was constructed proves correct, then its construction coincides with the great period of famine in the Valley of Mexico in the middle of the 15th century, when starvation was so severe that men were willing to sell themselves as slaves to the people of the east coast to obtain sufficient food. Indeed, Plate II of the *Códice en Cruz* combines under the date sign of 1 Rabbit (1454) the signs which stand for the construction of Tetzcutzingo with the sign of a naked child vomiting liquid, the symbol of a dry spell and starvation.[23]

We should like to suggest that wide-spread starvation and the building of the irrigation system described bear some sort of relationship to each other. We must keep in mind that the lagoon of Texcoco was considerably larger and the flat belt much smaller in both pre-Hispanic and colonial times than it is today. The expansion of the flat belt is due to the gradual drying up and shrinkage of Lake Texcoco. In Netzahualcoyotl's time, Tezoyuca, Atenco, Texcoco, and Huexotla were all located on the shores of the lake.[24] Within this narrow corridor, the natural increase of the population alone would inevitably exert pressure on available resources. This pressure would be increased by the repeated waves of Toltec immigrants. Given a tradition of agricultural improvement, it seems likely that the Texcocan systems of irrigation were constructed to meet the problems of increased population pressure. We are probably dealing with an area which was colonized planfully from an already established political center, spurred and organized by the state under the aegis of the "Toltecized" Chichimec kings.

IMPLICATIONS

The State as Entrepreneur of Irrigation Works. If our dating of the Texcocan system is correct, we must recognize that we are dealing with a case in which the state did not grow out of irrigation, but preceded it. There has been a tendency in recent anthropological writing to see in irrigation the primary cause of state formation, rather than one of a number of possible causes. Emphasis on the func-

23 Dibble, 1941. Plate II of the same Codex under the date sign of 2 Acatl (1455) shows another such child above the figure of a man stepping on a planted field. Dibble suggests that this might represent Netzahualcoyotl building the base of a temple. In the context of the material presented here, and interpreting the sign literally rather than symbolically, the male figure stepping on a field might represent Netzahualcoyotl or another personage of importance in some relationship to agriculture, perhaps to agricultural improvement.

24 See map in Gillmor, 1949.

tional importance of irrigation and a strong interest in cultural causation should not, however, lead us to over-generalize our data. The Old Acolhua domain achieved political consolidation under the fourth king of the Chichimec dynasty, Quinatzin, in the beginning of the 14th century. This unity was reëstablished before construction began on the Tetzcutzingo when King Netzahualcoyotl returned from exile in 1431. We have indicated above that the construction of the Texcocan system would seem to represent the culmination of the efforts of the Chichimec dynasty in the economic field. Once established, of course, irrigation probably operated in turn to centralize and intensify political controls.

This raises the question whether we are dealing with an isolated case, or with a more general Mesoamerican pattern. Post-Formative cultural development in Mesoamerica falls into two large over-all stages. The first was characterized by the rise of great ceremonial centers like Teotihuacán, some of which seem to have become "true" cities. The second stage has been labelled "militaristic," and was characterized by the development of a large number of warring city-states. These two stages seem to have occurred also in the growth of hydraulic civilizations in the Old World.[25] But there, it should be noted, both the earlier theocratic stage and the later militaristic stage were characterized by irrigation agriculture. So far no evidence has come to light that the theocratic ceremonial centers of Mesoamerica were in fact based on irrigation. This has been asserted, but never substantiated.[26] Until further research uncovers evidence of irrigation in the vicinity of Teotihuacán and Monte Alban and allows us to judge the scale of such watering systems, we must admit the possibility that the ceremonial centers of Mesoamerica became "true" cities and gave rise to states without a technological basis in irrigation. New and highly productive soils which could support a high density of population, food resources making for an adequate dietary balance, the development of transportation by water and the organization of human carriers, a high development of craft production and trade, a multiplication of the organizational functions exercised by the priesthood may all have been interrelated factors in the development of the large Mesoamerican ceremonial centers.[27] Should irrigation be shown to have been absent or of relatively minor importance during the theocratic stage, Mesoamerican development and the growth of hydraulic civilizations of the Old World would show convergence, rather than parallelism.

The Scale of Pre-Hispanic Irrigation. We believe that our data on irrigation in the Old Acolhua domain can be taken as further evidence that irrigation was

25 Steward, 1949, pp. 12-16.

26 For recent discussions of this point see Millon, 1954, and the forthcoming results of the Symposium on Irrigation, Julian Steward, ed., to be published by the Social Science Office, Panamerican Union, Washington, D. C.

27 Palerm, 1955.

of importance in pre-Hispanic times. Even if it should be demonstrated that it had little influence on the development of a theocratic order in Mesoamerica, its established functional importance in other parts of the world requires that attention be paid to it in any analysis of Mesoamerican social and cultural systems. Recent investigations[28] have demonstrated that Kroeber's earlier dictum to the effect that "there is little evidence that irrigation was of basic importance anywhere in Mexico, in pre-Spanish times"[29] is no longer tenable.

At the same time, it would serve little purpose to exaggerate the scale of irrigation in Mesoamerica. The Texcocan system certainly represents one of the largest irrigation systems known to date in Middle America. Yet its construction cannot compare with the massive systems of dykes and dams characteristic of the hydraulic societies of the Old World and Peru. Rather modest in scale, it served to integrate a number of communities or settlement areas into what might be called an "irrigation cluster." Such irrigation clusters appear to have had a wider distribution in Mesoamerica. Armillas has described one such cluster in the headwaters of the Atlixco River,[30] and Palerm makes brief mention of another near Tecomatepec in the State of Mexico.[31] A third formation of this type may have existed in the area of Tacubaya-Coyoacán. Such clusters seem to fit the category of "district irrigation," established by Robert F. Murphy in a yet unpublished paper.[32] They differ from "local irrigation" in that the individual community lacks direct access to water, and the problem of allocating water can no longer be met within one community alone. At the same time, such district irrigation lacks the massive character of larger systems comprising several districts. The irrigation cluster discussed here lent a cohesion to the Old Acolhua domain which it might not have acquired otherwise. It is important to note that the limits of the domain coincided closely with the limits of irrigation in the area. Huexotla, marginal to the system of water distribution, was also marginal politically. The domain retained its unity even when the political structure of Texcoco reached out to include a wider area and a larger and more diverse population. Certainly, once the state expanded, the very marginal location of the domain in the narrow corridor leading from north to south along the eastern shore of the lake would have tended to reduce the area to secondary importance, had irrigation not provided a permanent backbone of political cohesion.

Theoretical implications. The modern picture of the area might seem to lend itself to historical reconstructions of the kind used by Redfield in his study of

28 Armillas, 1949; Palerm, 1954.
29 Kroeber, 1939, p. 218.
30 Armillas, 1949, pp. 98-110.
31 Palerm, 1952, pp. 200-201.
32 Murphy, 1955.

culture change in Yucatan.[33] Today, the communities of the flat belt are clearly heavily involved in an outside market, and through the market with the culture of Mexico City. The sierra communities are much less dependent on outside markets, and more isolated. Other cultural differences seem to go hand in hand with this apparent continuum. More people speak Nahuatl in the sierra; fewer do so in town. "Indian" dress is more common in the mountains; it is rarely met with in the vicinity of Texcoco.

Historical reconstructions based on a mechanical interpretation of the hypothesis that culture change tends to operate from the pole of a "folk society" with a "folk culture" to the opposite pole of an "urban society" with an "urban culture" would, however, lead to serious misinterpretations of the past when applied to the history of the area under consideration. One must not forget that the concepts of the "folk society" and "urban society" represent ideal types, mental constructs to which no known societies correspond precisely.[34] The heuristic value of these concepts is most apparent when social and cultural processes are discussed at the highest level of abstraction, where the universe of discourse is the global history of Man.[35] The conversion of such abstract theoretical models into the supposed termini of real culture change tends to substitute pseudo-historical extrapolations for a scientific inquiry into the various aspects of the problem. In the case of the Old Acolhua domain, both archaeological remains and historical sources indicate that the society of the hill and sierra country was more complex in the past than it is at present. The area seems to have undergone a process of cultural devolution, a process of reduction in complexity, since the period of the Spanish Conquest. Evidence shows that agriculture was more intensive, covered more ground, and fed more people in pre-Hispanic times than it does today. Organizationally, we also witness a change in complexity, from centralized water controls resting in the hands of the state to decentralization into the hands of local bodies of water commissioners.

Such a process of devolution within the Indian sector of society seems to have occurred many times in Mesoamerica; and if we are to understand the history of Mesoamerican civilization, we must attempt to understand the dynamics of this devolution. It might indeed be said that the Old Acolhua domain experienced a reduction in cultural complexity, precisely because Mesoamerica as a whole achieved a new level of socio-cultural integration in the formation of New Spain. Under the Spaniards, Texcoco became a center of wool production, and sheep raising and wheat farming took the place of irrigated corn agriculture. Both sheep

33 Redfield, 1941.
34 Redfield, 1947, p. 294.
35 Redfield, 1953.

raising and deforestation to supply wood to Spanish enterprises and cities further increased erosion, and made the trend away from intensive agriculture irreversible. Thus intensive agriculture and terracing survived in a few villages of the piedmont only.

This type of culture change has not received much attention from the theoretical point of view. Julian Steward's concept of levels of socio-cultural integration enables us to analyze major changes in the complexity of socio-cultural systems.[36] Yet the problem at hand concerns not so much major transitions from one level of integration to another, but the internal organization of the systems themselves. It seems likely that the different parts of larger emergent systems produced by transitions in level of integration need not undergo integration with the same degree of stringency. Some of the constituent parts may indeed have to undergo wholesale reorganization to make them congruent with the demands set by the new level. Other parts may merely undergo minor adaptations. Still other components cannot be assigned a positive role in the new order, and undergo a reduction in functions and complexity. In other words, some parts of a larger system may become "marginal," and non-functional with regards to the operation of the larger system as a whole, while others acquire new functions which are strategic in its maintenance.

Other disciplines have long made use of the concepts of "key" and "marginal" areas, especially in discussing differences in the functional importance of different geographic areas.[37] While these concepts have often been implicit in anthropological discussions, few anthropologists have made them explicit. In discussions of Mesoamerica, Armillas and Sanders have demonstrated the utility of viewing the Valley of Mexico as the key area of Mesoamerica.[38] In the analysis of a particular region within Mesoamerica, we possess two outstanding contributions: Stanislawski's paper on the political geography of the Tarascan area,[39] and Aguirre Beltrán's brief discussion of the cultural relationship between the sierra and the lake district throughout Tarascan history.[40] Unfortunately, these contributions have not received the theoretical attention which they would seem to deserve.

Anthropologists are of course familiar with the term "marginal" from diffusion studies. In the present context, however, we are not referring to the distribution of culture traits in space, but to types of socio-cultural systems subsumed as parts

36 Steward, 1951.

37 These concepts belong to the standard repertory of the German geopoliticians. Ch'ao Ting Chi (1936) seems to have been the first to couch them in terms which are acceptable to the modern anthropologist.

38 Armillas, 1951; Sanders, 1953.

39 Stanislawski, 1947.

40 Aguirre Beltrán, 1952, pp. 49-51.

of larger systems. The emphasis in our use of the term is not on *where* these component systems occur, but on *how* they function, and on how they function with relation to each other. Such systems may in fact occur side by side in the same area, as in many parts of the Valley of Mexico today. It would therefore seem more appropriate to speak of "key" adaptations—strategic relationships between certain aspects of the environment and the culturally available technology—and "marginal" adaptations, and of their relationships to the strategic or key sector of the society under analysis, or to the marginal sector of that society. Such an explicit distinction of the functionally strategic and the functionally secondary components as applied to New Spain would allow us to explain the phenomenon which is the subject of the present discussion. After the Spanish Conquest, the Old Acolhua domain was transformed from a key area into a marginal area. Its social structure was relegated to the marginal sector of the new society. It underwent a cultural decline, because that society was based on new strategic functions which the Old Acolhua domain could not supply. It follows from this conclusion that the condition of the Indian villages of the area today offers no safe guide to their condition in pre-Hispanic times.

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SAMPLING RELIABILITY IN ETHNOLOGICAL FIELD WORK

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THE PROBLEM

IS THE METHOD of sampling customarily followed in ethnological field work reliable? It seemed possible to throw some light on this question during a research visit to West Pakistan in 1952.[1] The basic object in the trip was to learn the reactions of rural audiences to American informational films presented in the Urdu language by the United States Information and Educational Service. Findings were to be related to cultural and other factors in the situation. We worked in three villages, numbered in Table 1 as follows: (1) Tciho, Sind Province; (2) Tordher, Northwest Frontier Province; and (3) Chak 41-MB, Punjab Province. To ascertain the composition of the audience and the degree of understanding with which people saw the films, respondents were interviewed. A different Pakistani interpreter served as assistant in each of the three localities.

Always in previous field work we had employed the traditional method of ethnological sampling—using mature, willing informants who, perhaps, spoke English and were willing to describe relevant aspects of their cultures. The problem of how safely the information received from such sources can be generalized for a whole community has received increasing attention from anthropologists in recent years at the same time that more rigorous methods of sampling have appeared in field work. In Pakistan we determined to select both an opportunistic sample—as is customary in ethnology—as well as a random sample (stratified where possible). We would compare the categories in terms of responses given in the interviews. The present paper presents the results of the experiment.

Opportunistic sample subjects were secured in various ways. Sometimes the ethnologist walked through a village with an interpreter seeking out otherwise unoccupied respondents. Also we subjected men who visited our home to interviewing and sent out assistants to find respondents. Often, when visiting a courtyard or the shady grove overhanging a Persian wheel in search of a sample subject, the investigator or his wife encountered other people who agreed to answer questions. (Female respondents remained few and were randomly drawn only in the Punjab village.) Random samples were devised to insure that every eligible person

1 Field work was conducted under the direction of the Institute for Research in Social Science of the University of North Carolina, Dr Gordon W. Blackwell, Director. Results have been published in a report currently out of print: see J. J. Honigmann, *Information for Pakistan* (Chapel Hill, Institute for Research in Social Science, University of North Carolina, 1953, mimeographed).

in the community of whom we had information (i.e., males over eighteen, although in a Punjabi village females as well) would have an equal chance of being selected. The person whose name had been drawn was then assiduously sought for. Refusal to be interviewed occurred practically never. In several cases, however, randomly selected subjects remained absent from the village throughout the period of field work and in two villages a small proportion could never be located. Substitutes were drawn for those cases.

The principle hypothesis being tested follows:

The opportunistic sample in each village and in the combined villages will be different significantly (in composition and response) from the random sample.

From the analysis we hoped to be able to hypothesize further that the opportunistic sample differed significantly from the random sample with respect to such variables as might indicate that persons with certain characteristics in the total population tended to attract the anthropologist's attention or were attracted to his company.

Actually, we first tested the null hypothesis that the random and opportunistic samples in each village (as well as in the combined three villages) were *not* different, i.e., they consisted of persons similar in respect to the variables. For this we calculated the chi squares for all variables. Differences found between the samples, according to this hypothesis, should be due to chance alone. If the differences between the two categories were found to be significant (p at the .05 level or lower), then the differences could not be ascribed to chance but, we assumed, indicated that the samples were different. In that event our initial hypothesis would be confirmed.

RESULTS

Relatively few differences at the .05 level of probability or lower obtain between random and opportunistic samples. Audiences saw eighteen films and only in one village, in the case of a single picture, did the difference between the samples reach the .05 level. For this reason we have omitted any statement of p values for the films from this paper. Do the random and opportunistic samples behave similarly from one village to another with respect to comprehension? It may be claimed that should this be the case, then we have further assurance of the reliability of our finding that the categories tended to be homogeneous with respect to understanding the films. In Tciho and Tordher (Villages 1 and 2 in Table 1), where Sindhi and Pushto are spoken respectively, "insignificant comprehension" occurs with modal frequency in both the random and opportunistic samples. In the third village, where the language, Punjabi, is closely related to Urdu (the language of

the film sound tracks), responses are more evenly distributed between insignificant and good comprehension. Here, too, the samples differ considerably from each other in respect to comprehension. Consistency among the three villages, therefore, is limited, throwing doubt on our conclusion of homogeneity. (It must be pointed out that when working with audience response to individual films the number of cases often remained quite small and cells in the tabulations for chi square calculation several times contained numbers below five. Working with such small numbers and using the chi square test warrant no claims of great preciseness.[2])

Table 1 includes the variables for which significant differences did appear be-

TABLE 1

Number of Respondents and Significance of Differences between Opportunistic and Random Samples in Three Pakistani Villages[a]

Variable	*Village 1* N	p	*Village 2* N	p	*Village 3* N	p	*Combined Villages* N	p
1. Attendance at more performances	50	.01	85	.001	61	.02	196	.001
2. Land ownership	—	—	74	.10	44	.20	118	.20
3. Length of schooling	—	—	74	.01	42	.70	116	.05
4. Social category ("class")	40	.95	75	.01	42	.90	157	.05
5. Admitted understanding of Urdu	—	—	75	.01	41	.98	116	.02
6. Familiarity with radio programs	—	—	—	—	39	.90	—	—
7. Awareness of government presenting the films	48	.05	84	.01	61	.40	193	.01
8. Comprehension of Urdu titles	31	.05	—	—	—	—	—	—

2 For great help in suggesting appropriate statistical procedures and directing analysis we are indebted to Dr Daniel O. Price. Both he and Dr Grant Dahlstrom reviewed the manuscript before publication.

3 Dash indicates absence of data.

TABLE 2

Variables Distinguishing Random from Opportunistic Sample in Three Pakistani Villages

Variable	*Random Sample* N	%		*Opportunistic Sample* N	%
3. Length of schooling					
0-4 years	65	79		21	62
5-8 "	16	19		8	23
9-14 "	1	1		5	15
Totals	82	99	(P = .01)	34	100
4. Social category ("class")					
Upper	10	9		4	17
Middle	64	60		11	46
Lower	33	31		9	37
Totals	107	100	(P = .70)	24	100
5. Admitted understanding of Urdu					
None	34	42		7	20
Poor	19	23		8	23
Good	13	16		3	9
Excellent	15	19		17	49
Totals	81	100	(P = .01)	35	101

tween the two samples. Contrary to what we discovered in the case of comprehension of the films, with respect to background factors (including attendance and awareness) the samples tended to be different from one another and in Tordher (Village 2) to such a degree (except for variable 2) that there is less than one chance in a hundred of the differences being due to chance. Table 2 tests the hypothesis that in all the villages the ethnologist (or his assistants) tended to secure respondents who differed significantly from the general population in qualities that made them more attracted or attractive to a professional stranger and college-educated interpreter (variables 3, 4, and 5).[4] This hypothesis is supported with regard to length of schooling and admitted understanding of Urdu (manifestly related characteristics of a person) but not with respect to membership in

4 Such differences scarcely appear in the third village, which is a planned resettlement of Muslim refugees from what is now East Punjab (India). This village lacks a formally educated landlord class. All but half-dozen men are farmers and practically every adult male possesses about the same degree of sophistication.

social categories. Inspection of our original data reveals that differences between villages were again not consistent with regard to the three variables of Table 2. For example, in Tordher, a densely settled locality of over 8,000 population, the opportunistic sample contained twice as many people with 5 to 14 years of schooling as the random one. But in the more homogeneous Punjab village, both samples were weighted with unschooled persons. In Tciho we drew a stratified random sample. However, here as well as in Tordher the opportunistic category included more "lower class" persons than the random one and in Chak 41-MB the samples do not differ with regard to class. More than half of the randomly selected subjects in Tordher claimed to know no Urdu but more than half the opportunistic sample reported "excellent" grasp of Urdu, a finding in the expected direction. In the Punjab both samples were about evenly matched for language ability.

SUMMARY AND CONCLUSIONS

Analysis of random and opportunistic samples interviewed in three villages of West Pakistan does not bear out the hypothesis that an opportunistic sample, such as is frequently selected in ethnological field work, differs significantly from a random one.

The experiment revealed that the samples tended to differ significantly only in certain related background characteristics (like length of schooling, social category membership, and admitted understanding of Urdu) but not consistently so from one village to another. They also differed with respect to attendance at the film performances and, whether attending or not, in regard to accurate knowledge of the government which had come to show the motion pictures in the villages. Those persons in each sample category who attended the performances practically never differed significantly in their understanding of what they saw and heard. This allows the deduction that both samples were homogeneous with respect to ability to comprehend the motion pictures, although the level or understanding is not consistently different between the samples from one village to the other.

There is some indication that members of the opportunistic sample tended to be selected (unconsciously) from among those persons in the villages who were among the most sophisticated and hence more likely to attract, or be attracted to, a professional stranger and college-educated interpreter.

The inconsistent statistical results and variation from one village to another suggest caution in applying these findings. Obviously a single experiment of this kind allows little generalization or advice for field workers who may work with problems far removed from motion picture effectiveness. At best one can be warned not to assume that an opportunistic sample will approximate a random sample in all respects. Meanwhile, more use of sampling experiments in field

work is desirable in order to clarify relationships between the mode of selecting informants and the kind of information that is acquired. For best results future research should work with variables pretested to insure their diagnostic value for distinguishing between two samples. It is likely that rural Pakistani villagers on the whole were about equally able to understand the films. Hence, questions bearing on the content of the motion pictures possessed little diagnostic value.

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THE PROBLEM OF ABORIGINAL PERSISTENCE*

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THE FULNIÔ INDIANS OF AGUAS BELAS, PERNAMBUCO, BRAZIL (W. D. HOHENTHAL)

DESPITE THE PASSAGE of several hundred years of Caucasian cultural domination in the vast *sertão*, consisting of xerophytic scrub-forest and cacti which covers much of northeast Brazil, there are a surprising number of surviving Indian groups which still regard themselves as distinct ethnic and cultural entities. That these aboriginal descendants usually present evidence of long-time and continuing racial intermixture with Negroes and Caucasians, and that they sometimes are culturally indistinguishable from the local Neobrazilian populace, does not prevent them from considering themselves to be "true Indians."

Some of these groups do retain an impressive amount of aboriginal tradition as reflected in their material culture, social organization, and religious beliefs. An outstanding example is the Fulniô tribe, numbering some 1,200 souls and speaking a linguistically isolated language referred to by them as *Iaté*. The Fulniô now occupy a reservation of four square leagues administered by the Brazilian Indian Service; within their lands is a mountain range, Serra do Cumanatí, which overlooks the small town of Aguas Belas (lat. 9°5′S, long. 37°0′W) in the state of Pernambuco.

History

Between 1681-1685 Indians known as Carapotó, and living in the Serra do Cumanatí, were catechized by Frei José de Bluerme, but were not mentioned again for many years. In 1759 they were reported as being on the nearby Rio São Francisco, in the vicinity of Collêgio in the neighboring state of Alagôas.

During this interlude a Royal Letter of June 5, 1706 granted two square leagues of land in the same Serra do Cumanatí to another tribe called *Carnijó*, which even today is a synonym for the Fulniô. Exactly when or whence the Fulniô came to this place is not known. Indian traditions are vague, and refer only to a period of warfare involving the movements of many aboriginal peoples, possibly in response to Portuguese pressure from the coast, which tend to be supported by 18th century documents. One Fulniô tradition avers that they came originally from Pé de Banco, far to the west in the *alto sertão*, which would put them near terri-

* Two papers read before Section H, American Association for the Advancement of Science, December 1954, at Berkeley.

tories occupied by Gê-speaking Indians, whom they indeed resemble in many cultural respects.

Historical information of the 18th-19th centuries shows clearly that, despite missionizing efforts by padres of the Order of São Pedro, the Fulniô constantly shifted their place of residence between the neighboring states of Alagôas and Pernambuco and also within those states. For instance, in 1844 many Fulniô were hunted down and shot by local Neobrazilian ranchers; they abandoned the Serra do Cumanatí and wandered for a time in the more remote Serra da Tiricá. Prior to 1851 many Fulniô again fled to the sheltering Serra Negra, far to the west, but eventually returned to their old haunts. In the 20th century the Fulniô once more abandoned their village and moved to Sant'Ana do Ipanema, some leagues to the south. It was not until 1924 that the Indians finally settled where they live today. These two hundred years of enforced wandering have influenced the Fulniô to the point where even today they have no tradition of, or loyalty to any particular geographical locality, and they still feel insecure despite present governmental protection.

Socio-Cultural Description of the Fulniô

Economy:

The Indian Service attempts to instruct the Fulniô in Western agricultural techniques and animal husbandry, but with indifferent success; the majority of the Indians show little interest and prefer to live by selling objects woven by them of palm fronds and a fibre known as *caroá*. A typical Fulniô prefers to rent his government-granted lands for a pittance to a local White man rather than farm it himself. Despite this self-inflicted dependence on the local Neobrazilians, the Fulniô do not like them, and the feeling is mutual—social relations between the two people, while overtly "correct," are not good. So suspicious are these Indians of all White overtures, however sincere and honorable, that most are rejected as sly and ingenious efforts to undermine the Fulniô nation.

Aboriginal Fulniô economy rested on hunting, fishing, and collection. Today hunting is of no consequence owing to the disappearance of game, but the gathering of wild vegetal foodstuffs even now looms importantly in their diet, as does fishing by use of narcotics and nets in nearby streams.

Language:

Their aboriginal language *(Iaté)* is to the Fulniô one of the most important factors in their survival as a distinct group. It is a means not only of continuing their culture and traditions but is also a means of protection against the local Whites who cannot understand what the Indians are saying. The Fulniô believe

that their ancestors were "great men" to have left them the heritage of a distinct language, since neighboring tribes have forgotten or bastardized theirs.

The older Fulniô attach such importance to this that they do not wish their children or grandchildren to attend the Indian Post school for fear that in learning Portuguese they will forget *laté*.

Amongst themselves oratory is very important and the old men use a kind of archaic speech as an oral device to exclude the uninitiated from their private conversations; in addition, there exists an esoteric language for religious ceremonies, the vocabulary differing from ordinary speech. But perhaps because of the use by elders of archaic speech forms and increased education in Portuguese (owing to governmental pressure) the younger generation are relinquishing the purity of even ordinary native speech and are drifting away from the ancient standards, to the alarm and disappointment of the old folks. In former times young men who "slacked off" on learning and practising tribal lore were physically punished by their elders, who now lament that such is no longer done.

Society:

Basic to Fulniô society is the concept of dualism, which also extends to the supernatural. The tribe is divided into two patrilineal exogamous moieties, unnamed, but oriented to the east and west. Within the East Moiety are two named patrilineal exogamous sibs, *Falê-da tó* ("Duck") and *Txo-o kó* ("Fish"); similar social units for the West Moiety are *Walê-da tó* ("Pig") and *Lildya-ká* ("Parakeet"); in addition there is a fifth sib, the *Seda-i tó* ("Strangers"), whose members do not participate in esoteric rites but who merely observe from the sidelines.

These sibs are bound up with totemic proscriptions: all things in the universe, organic or inorganic, are apportioned amongst the various sibs, and thus to a certain sib-member various life forms and objects are strictly taboo.

Descent is patrilineal, except that if a Fulniô woman has a child by a non-Fulniô man, the child is assigned to its mother's sib. The implication of this shift may be seen in cases where members of the same sib marry, in opposition to the general rule of sib exogamy.

Such cases, revealed by genealogies, were rationalized by the Indians on the grounds that a child of a Fulniô mother of a particular sib and a non-Indian father was not of the same order as a child patrilineally assigned to the same sib, and thus marriage was possible, which illustrates succinctly that descent of any order is merely social allocation, and fundamentally has nothing to do with genealogy *per se*.

Although a Fulniô is automaticaly assigned at birth to one or another sib, still he must be initiated into it at puberty, or even before, during a ceremonial period

called *urikurí* (from a palm of that name which figured largely in aboriginal religious belief, *Cocos coronatus* Mart.), which lasts from September to late November. Only boys actually undergo the initiation; male children are definitely preferred, as thus only, in native belief, can the Fulniô nation survive. This idea goes far to explain the equanimity with which Fulniô fathers view the untimely death of their little daughters and the obvious grief associated with the death of their infant sons, often occasioned by tetanus or the ubiquitous gastrointestinal afflictions which assail so much of the population of northeast Brazil. No special boys' puberty rite as such exists any more; apparently there never was one for girls.

Definitely preferred among the Fulniô is cross-cousin marriage, which of course agrees with their system of sibs and moieties; parallel cousins are regarded as being more closely related. The couvade, lasting from fifteen to thirty days, is still strictly observed, and menstrual avoidances are still practised.

Fulniô society constitutes a definite "in-group"; any person who fails to meet tribal standards for what a Fulniô is supposed to be is rigorously excluded. Interestingly enough, a Fulniô often judges whether a person is an "Indian" more according to behavior, sib affiliation, linguistic fluency, and esoteric knowledge rather than by mere physical appearance or ancestry. Thus, a mulatto who meets the above requirements might get the nod over a person who racially has the better claim to being an Indian.

As a group the Fulniô are independent, aggressive, and very proud; they are quick to anger and slow to forget a wrong, and consider themselves to be a "master race." Amongst themselves—particularly women—they are exceedingly quarrelsome, and daily fights are the rule rather than the exceptions. Killings are not infrequent.

Even so, the Fulniô still have cohesion as a tribe, and public pressure and joint determination can do much to accomplish various matters. For example, an internationally-known anthropologist visited me in the field, and on the last night of his stay his watch was stolen from his dwelling by an Indian. On complaint to tribal officials—chief, shaman, and sib chiefs—the missing watch was soon returned. Who stole it or how it was returned is beside the point; the fact is that because of social pressure within the group the purloined object *was* returned, and this is to me significant.

Religion:

The few Fulniô who go on rare occasion to the Catholic church in nearby Aguas Belas aver that they do not understand the padre half the time, but that at the *urikurí* they do understand the shaman, hence the latter has far more influence on their belief and conscience. Even so, they have retained something of early mis-

sionary teachings in their religion, which is a syncretism of largely aboriginal belief, a measure of Afro-Brazilian cultism, and some greatly transmogrified Christian notions.

Every Fulniô, no matter where he or she is at the moment, has the obligation to return and participate in the esoteric rites involved in the three months ceremonial cycle known as *urikurí*. What is remarkable is that the place of ceremony is usually located in a hot, dusty, and desolated clearing in the *sertão*, at least six kilometers from the Indian Post, and all water for drinking and cooking must be carried there in earthenware pots. Yet, despite all discomforts acculturated Fulniô from as far away as Recife give up their monetary gains of the moment to attend the rites, and Fulniô men, drafted into the Brazilian Armed Services, have been known actually to desert their units in order to attend the *urikurí* should their requests for furlough not be granted. This is of the greatest psychological significance to our problem of cultural persistence with this group.

Fulniô religion is essentially animistic. There are departmental and tutelary deities, all of which are associated on the principle of dualism with certain sibs, as are a number of animal divinities.

Dualism is basic to these Indians' faith, and important here is the cyclic myth of the two brothers, one of whom is young, intelligent, and who wishes to help mankind; the other being an older, stupid or inept individual who constantly sets his younger sibling's efforts to naught. The names of these supernatural beings, *Walê-da tó* and *Falê-da tó*, are preserved in the present-day sib designations. Another dual personality is *Wal'ka lhá*, the "Trickster," who sometimes aids, sometimes harms mankind. Other supernatural entities are Lord of Forest, Snake Goddess, and Mother of Waters.

A central part of Fulniô religion is represented by the Jurema Ceremony. Jurema (*koña-lhá* or "sacred drink") is prepared from the inner bark of a small tree (*Mimosa nigra* Hub.), which is rich in tannin. The narcotic decoction is usually prepared by the shaman: the bark is carefully pounded and mixed with water to produce a deep-red liquid which, when imbibed together with a measure of self-hypnosis induced by monotonous chanting, the blowing of whistles made of anteater claws and armadillo tails, and the smoking of strong tobacco, results in a trance during which the participant makes contact with supernatural beings from Beyond. This rite is shared by other surviving Indian tribes in northeast Brazil.

Shamans cure patients by oral suction accompanied by the blowing of tobacco smoke over the victim by means of a baked-clay pipe; chanted prayers and singing also figure importantly. Disease is believed to be caused by intrusion of pathogenic

objects and also because of soul loss. Imitative and contagious magic are also resorted to by shamans to cast spells.

In regard to soul-loss the Fulniô believe that every male person has three souls: one in the head, another in the mouth or lungs, and a third in the heart; but a woman has but two souls, one in the mouth, another in the heart but none in the head "as women are senseless." The souls appear in the third month of foetal development, and one knows this because a woman begin to vomit in the third month of pregnancy, thus showing that "the souls already have existence of their own." When all the souls leave the body death results.

Summary

To sum up, this stubborn retention of traditional Fulniô ways may be attributed to the following:

First, their emphasis on retaining and speaking their native language *(latê)* in preference to Portuguese, which sets them apart as a distinct cultural group in the Neobrazilian populace.

Second, their insistence on a closed society wherein no non-Indian and hardly even any non-Fulniô Indian may be permitted to enter through adoption or marriage; if a tribal member does marry an non-Fulniô the latter is excluded from the *urikuri,* although the children of the union are permitted to attend.

Third, their active appreciation, understanding and preservation of their own aboriginal traditions, through tribal education of the younger generation; such traditions and beliefs are kept secret from local Neobrazilians on pain of death for the informer.

Fourth, their seasonal cycle of esoteric rites and ceremony lasting three months which all adult Fulniô are obliged to attend.

Fifth, owing in part to a limiting environment and retained aboriginal technology, and to the great suspicion with which the Fulniô view Caucasians because of past aggression, the Indians prefer to go their traditional ways despite a benevolent governmental policy.

Sixth, because the Fulniô regard themselves as superior beings by comparison with neighboring tribes, and act as such, this undoubtedly resulted in a certain measure of native exclusiveness which in turn may have invited Caucasian persecution because the intransigeant Fulniô failed to conform to the pattern of Indian humility and submissiveness demanded by Neobrazilians.

Seventh, the Fulniô preferred changing their residence frequently and losing all claims to their lands as granted by the Portuguese kings and confirmed by the Brazilian emperors rather than submit to White standards of what Indian behavior

should be; thus while the Fulniô have no tradition of nor loyalty to any particular territory or community, their emphasis on native cultural values and orientation has sustained them through several centuries of active alien persecution and cultural conflict.

Conclusions

Here is a case of a native people essentially inner-directed and against the alien world, with a consequent emphasis on ethnocentrism because of an over-weening belief in their own racial, cultural, and linguistic superiority. Because of these factors this people has managed to survive as a distinct cultural group despite the most active efforts of their immediate Caucasian overlords to extinguish them or to submerge them within the general populace of northeast Brazil. We may say that so long as a people are well integrated in their particular culture, preserve it because of active participation in all aspects by a majority of the members, and strengthen it because of sincere attention to the implicit and explicit cultural values, this people has a good chance to withstand the shocks and strains of alien cultural impact of even a dominant nature.

THE INDÍGENAS GUAYQUERIES OF MARGARITA ISLAND, VENEZUELA (T. McCORKLE)*

The Brazilian Indian group described by Hohenthal represents the end product of one series of responses to European contact. The Fulniô of Aguas Belas have turned their backs on a dominant alien society and directed their interests toward values to be found within their own culture. The group now to be considered—the Guayqueries of Margarita Island—are inhabitants of the same part of the world: that region marginal to the South American area of Tropical Forest Horticulture. The Guayqueri adjustment to a world dominated by Europeans is a very different one from that of the Fulniô, and these two papers are offered together in the belief that comparison may prove instructive.

Margarita Island lies twenty miles off the northeastern coast of Venezuela. Small and semi-arid, it has many pleasant beaches but few natural resources other than the fish and shellfish to be found in adjacent waters. Discovered for Spain in 1499 or 1500, its people have experienced 450 years of intensive European contact.

The people of Margarita Island are a racial mixture of European, Indian, and African descent. They take pride in their island and call themselves Margariteños rather than Venezuelans. A minority of four or five thousand of these islanders are known to themselves and to others as Indígenas Guayqueries, which

* Fieldwork on Margarita Island in 1952-53 was financed by the Henry L. and Grace Doherty Foundation of New York.

here simply means natives of the island, for they speak only Spanish and no one thinks of them as Indians. The Indígenas Guayqueries constitute a community that represents the aboriginal population and that owns and controls territory that is vital to the development of the island's largest city. Their territory is policed by officers appointed by Venezuelans, but the Guayquerí community also elects a ruling body that is independent of national politics and that deals with State and National officials on something like an equal footing. Far from being an encysted or inner-directed minority, the Guayqueries are full-fledged Venezuelans in race, language, culture, and citizenship. Membership in the Guayquerí community is a plus-value: it gives them certain privileges not enjoyed by their non-Guayquerí neighbors.

Guayquerí and Fulniô

Economy:

The aboriginal Fulniô were a hunting, fishing, and collecting people. Their modern economy is not much more elaborate, and is partly separate from the general economy of Brazil.

The aboriginal Guayqueries fished, hunted, cultivated maize, manioc, and native fruits, and traded pearls and produce to neighboring Indians of the continent. The 16th century Guayqueries entered into the Spanish system actively—not as mission Indians or as slaves in the pearl-fisheries, but as military auxiliaries in operations against natives of the Venezuelan coast. In the post-conquest period the Guayqueries became the fishermen who supplied the whole region from Maracaibo to Puerto Rico and Trinidad.

A few modern Guayqueries carry on traditional crafts such as the manufacture of hammocks and pottery, but most are occupied as commercial fishermen, sailors, market-women, taxi-drivers, house-builders, storekeepers, laborers, or smugglers. Virtually every transaction is an exchange of goods or services for cash, and they enter into the regional economy to the same extent as do their non-Guayquerí neighbors. Craft-tradition and occupational status are never allowed to interfere with economic opportunity: although retail selling is women's work, a taxi-driver filled up the back of his cab with dried fish for retail sale. And all the potters of one settlement downed tools in order to take up less pleasant employment as openers of pearl oysters on another island.

The Guayqueries are an energetic people who consider work to be a good thing.

Language and Tradition:

While the Fulniô take deep pride in their language, both for itself and as a vehicle of tradition, the Guayqueries learned Spanish rapidly and abandoned their

native idiom by about the year 1700. Apparently they never attached any high value to their language, for there are no surviving vocabularies, and those non-Spanish words that are in common use have cognates in continental "Carib" and in island "Taino" dialects. It seems there never was any prejudice against borrowing from foreigners.

Guayquerí native tradition of any kind is signally lacking, except for the tradition of common descent from the aboriginal population. There is no interest in local history, and there is no resistance to Venezuelan education. Guayquerí children are brought up to behave like Margariteños, and the Guayquerí community uses its influence to persuade the national government to allocate additional schools to Guayquerí settlements.

Religion:

A major focal point of modern Fulniô culture is the native religion. Young people are given careful instruction; there is a body of secret knowledge; Fulniô men risk being charged with desertion from the Brazilian army in order to attend ceremonial functions.

In contrast, the Guayqueries never evinced any strong interest in religion. They are described in the earliest sources as "good Christians," and it was never thought necessary to establish missions on their island. Evidently they gave outward evidence of satisfactory religious behavior, but this may say only that they killed no priests and made no trouble by carrying on elaborate pagan ceremonies. The aboriginal religion cannot have been very distinctive, for it was never thought worthy of mention.

The modern Guayqueries are very weakly Catholic: possibly five percent go regularly to mass, while others never enter a church except as principals in a baptism or a funeral. No settlement (and one has 3000 inhabitants) supports a priest or the cult of a saint. The Virgin of the Valley, considered to be the patron saint of the Guayqueries, is housed in a church well outside of their territory. And while the written constitution that gives form to the community asserts a proprietary interest in this saint figure, the same constitution guarantees religious freedom to adherents of all faiths. Folk ceremonies are in the Spanish-Venezuelan tradition, but seldom does a Guayquerí put on a costume or play a musical instrument unless he intends to take up a collection afterward.

In 1952 some people remembered a healer who chanted, danced with gourd rattles attached to his ankles, and blew tobacco smoke on his patients, but this individual was described as "a Negro from the continent."

One drug plant is used, the flower of a relative of jimsonweed *(Datura)*, which is rolled with tobacco into cigars, but this is employed as a treatment for bronchitis

rather than to gain supernatural experience. Clearly there is no surviving remnant of the aboriginal religion.

Society:

Fulniô society retains much of its aboriginal flavor. It is a closed society in theory: outsiders are not welcomed; membership requires initiation and special knowledge; and those who marry in are excluded from its esoteric rituals. There is no evidence that Guayquerí ever was a closed society.

Guayqueries intermarried with foreign Indians in the pre-contact period. They mated with Europeans in the 16th century, and the products of such matches became leaders of the group. Early sources describe them as "caballeros and nobles" and as "His Majesty's loyal Guayqueries," a people who occupied a position superior to that of mestizos, Negroes, and "poor Spaniards."

Five island Guayquerí communities obtained territorial grants from the Spanish crown and, resisting republican legislation designed to dissolve village-dwelling native communities and to partition their land, maintained their special character into the modern period.

The ordinary modern Venezuelan local settlement is very much overshadowed by a paternalistic national government that collects most of the taxes and performs all of the public works. Local settlements have no elected officers, only a constable who is appointed from above and who must belong to the government political party. The Guayquerí community consists of eight local settlements all located within the jurisdiction of a single municipio. Their territory benefits by national public works and is policed by officers appointed from outside. But their community also has officials who are elected by the Guayqueries. These officials have Spanish titles and functions defined by the written constitution. They settle disputes, aid community members in distress, and parcel out community territory. They deal with the national government on something like an equal footing when they lease land in exchange for schools, roads, electric power and cash. Some of the cash is used to buy additional territory.

The modern Guayqueries constitute a separate group. Those who marry Guayqueries are not admitted to membership. However there are no esoteric rituals for them to be excluded from, and their children become full members of the community without initiation or special instruction. By comparison with Fulniô, Guayquerí is and has been a relatively open society. The Guayquerí community is a separate unit, but one that is Venezuelan in organization and character—an economic unit that also confers social and political advantages on its members.

Guayquerí personality conforms with local ideals of "tranquillity" and "friendship with everyone." It is difficult to provoke a Guayquerí to combat because

he is looking out for economic opportunities rather than insults to his honor, and such aggressive impulses as are felt are taken out in brief, loud arguments between women, or in making an occasion to take minor advantage of someone who need not be the original source of aggression. Fights between men are unusual, and killings are extremely rare on Margarita Island.

The Guayquerí individual feels secure and self-assured. He is part and parcel of Venezuelan society and perhaps only thinks of himself as a Guayquerí when it comes time to receive emergency medical or economic aid, vote for local officers, have some member of his family buried at community expense, or apply for the free use of land which others cannot buy but must rent or lease. At such times he can feel that other Venezuelans are members of an out-group that does not enjoy such rights and privileges.

Community Integration:

If the Guayqueries take no interest in their native language and retain nothing of their religious or other tradition, what is it that has allowed their community to persist as a distinct unit?

One factor is the tradition of common descent from the aboriginal population. A second is interest in community property. Economic interest in the joint property is the more important factor, as demonstrated by the experience of four sister Guayquerí communities. Those four communities consented to distribute their land among individual members in 1904. By 1952 all four communities had ceased to exist, and those who had been members no longer considered themselves to be Guayqueries. It is evident that the business of being a Guayquerí is very little a matter of sentiment and very much a matter of the advantages of community membership.

Summary

To summarize: where the Fulniô have several times changed their territory in order to keep their culture, the Guayqueries several times have changed their culture in order to keep their territory. Both groups have maintained distinct communities. The Fulniô have done this by turning away from the dominant group to sustain themselves with values to be found within their own cultural tradition. The Guayqueries have maintained their community by *joining* the dominant group while yet retaining privileges that are denied to other Venezuelans. These include:

(1) The right to own land in common.
(2) The right to use community land free of charge, to obtain emergency medical aid, and to be buried at community expense.
(3) The right to vote for local officials not controlled by outside authority.

By insisting upon these rights, the community has retained control over territory that has become valuable during the past four decades. Money derived from leasing land is being used to build up the treasury and to buy additional land. The Guayquerí community is lacking in exotic color or flavor, but it is gaining in wealth, population, and influence. The Guayqueries have made a highly successful adjustment to conditions of European contact.

Conclusions

The Fulniô can be called a problem group, in that the relations between the Fulniô and the Brazilians constitute a series of problems that legitimately might be referred to a cultural anthropologist for diagnosis and for suggestions that might lead to some more satisfactory adjustment.

The Guayqueries, on the other hand, constitute no problem either to themselves or to the Venezuelans—they neither desire nor need aid in adjusting themselves to conditions of Venezuelan life. Yet study of a group that, like the Guayqueries, has made an advantageous adjustment to life with European neighbors, may contribute some suggestions that can be of assistance in dealing with inner-directed peoples like the Fulniô.

First, it is important that the native group have an opportunity to make a successful adjustment. The Guayqueries were presented with the chance to enter Spanish colonial society as soldiers, a respected occupation, rather than as slaves or as mission Indians.

Second, it is important to ascertain whether there is congeniality or lack of congeniality between patterns of the native and the impinging foreign culture. The Guayqueries lacked customs that would have offended Europeans, such as idolatry or cannibalism. They were used to dealing with foreign Indians and had no prejudice against marrying foreigners. This open attitude, plus a bias toward situations of economic opportunity, helped them to find a congenial niche in a Spanish colonial scheme that had room for a small group who liked to travel, knew the languages of the region, and could furnish competent warriors.

Third, it can be important for the native group to learn all it can about the foreign culture. Unfettered by ethnocentric attitudes, the Guayqueries readily learned the Spanish language and Spanish, later Venezuelan, culture. They did this to such effect that they have been able to manipulate the Venezuelan legal system as well as any Venezuelan. At the same time, and due to their ability to manipulate Spanish-Venezuelan culture, they have been able to retain their distinctness by subverting such ideal patterns as the individual ownership of land.

While the case of the Fulniô shows that a people can survive severe shock provided a majority of its members are sincerely attached to values lying within its cul-

tural tradition, the Guayquerí case demonstrates that a group need not retain distinctive cultural practices in order to maintain itself as a separate and successful community.

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